

Phonak Insight

Serenity Choice™ – protecting hearing while providing best sound quality and allowing the ear to breathe

Serenity Choice hearing protection products meet the needs of hearing protection clients by first-and-foremost protecting their hearing against damaging noise. In addition, evidence shows that Serenity Choice Music outperforms competitors with regards to music sound quality. Furthermore, Serenity Choice products have been shown to allow the ear to breathe.

Appleton-Huber, J., June 2021

Key highlights

- Many people are exposed to damaging levels of noise and around 70% of them currently don't wear hearing protection.
- Serenity Choice products meet the needs or wishes of clients who would like to buy hearing protection.
- Serenity Choice Music outperforms its competitors with regards to music sound quality.
- Serenity Choice products have been shown to allow the ear to breathe which is important for comfort and maintaining good ear health.

Considerations for practice

- When shopping for hearing protection, clients prefer to buy via their Hearing Care Professional (HCP). Make sure your client knows you offer Serenity Choice.
- The Serenity Choice portfolio has a broad range of products to suit each individual client depending on their needs with regards to use case, attenuation level, ear canal size and more.



Why hearing protection is important

While sound can bring much joy to our lives, too much sound, or noise can be detrimental to our health. The National Institute for Deafness and other Communication Disorders (NIDCD), (2017) reported that 50% of young people listen to their music or other audio too loudly. The Centers for Disease Control and Prevention (CDC), (2018) also published data stating that 22 million (17%) of U.S. workers are exposed to hazardous noise levels at work. The consequence of being exposed to too much noise over long periods of time or being exposed to a very sudden loud noise can cause irreversible damage to our hearing. Audiologists are familiar with seeing a notch in the audiogram around 4kHz which is a classic sign of noise-induced hearing loss (see example in Figure 1.).

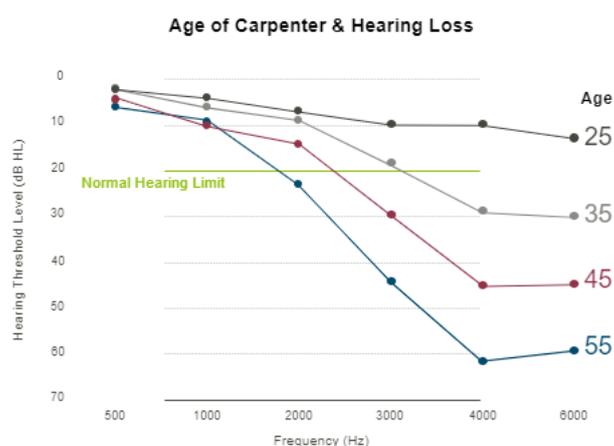


Figure 1. Example of the development of noise induced hearing loss over time. Note: Reprinted from Centers for Disease Control and Prevention: The National Institute for Occupational Safety and Health. Noise and hearing loss prevention: Facts and Statistics. Retrieved from <https://www.cdc.gov/niosh/topics/noise/factsstatistics/charts/chart-const.html>

A survey in the US, undertaken by the CDC, (2020) found that 70% of people exposed to loud noise, never or seldom wear hearing protection. As a consequence of this, the same survey found that 40 million U.S. adults have audiograms that are consistent with hearing loss resulting from exposure to loud noise. Furthermore The World Health Organization states that 1.1 billion young people (aged between 12–35 years) are at risk of hearing loss due to exposure to noise in recreational settings (WHO, 2020). The World Report on Hearing (WHO, 2021) estimates that worldwide, by 2050, nearly 1 in every 4 people can expect to have some degree of hearing loss, and 1 in 14 (at least 7%) will require hearing care. This same report featured a case study which showed that in 2002, rigorous implementation of a hearing conservation programme was undertaken in the Swedish Armed Forces, and its impact assessed after a few years. The results showed that the incidence of hearing loss in the affected population dropped to one third during a five-year period, having reduced to 2.3% from the earlier 7.9%.

What hearing protection clients want

Given the importance of hearing protection and the apparent lack of adoption of hearing protection, Phonak conducted a survey with 6420 participants to find out about their awareness of hearing protection and what would be important to them when choosing hearing protection (Knorr, 2021). One key insight from this survey was that when shopping for hearing protection, the most popular channel for purchase would be from the Hearing Care Professional (shop or webshop). When it comes to the main motivators for choosing hearing protection, the number one motivator was prevention of hearing damage. Other motivators within the top ten motivators for choosing hearing protection were perfect fit, keeps relevant sound and speech, enjoy best music quality at safe listening levels and lets the ear breathe.

Serenity Choice benefits

Serenity Choice hearing protection from Phonak meets the needs of clients looking to purchase hearing protection. It is available to purchase from HCPs, either via their webshop or in person.

Prevention of hearing damage

Serenity Choice products are certified and protect against hearing damage, by cancelling noise and loud sounds from 9 to 16 NRR (Noise Reduction Rating - US) or 16 to 24 SNR (Single Number Rating - EU) (Phonak, 2021). There is a broad portfolio of products for a variety of use cases, such as for music, working with loud power tools, sleeping, hunting/shooting and swimming.

Range of sizes, form factors and material to aim for the perfect fit

The generic form of Serenity Choice is available in 4 different ear tip sizes and the custom product, Serenity Choice Plus is tailor-made for the client. This guarantees a consistent level of attenuation for optimal noise protection. The custom product is also available in two form factors (Full Concha and Mini) and in two different materials (acrylic and silicone).

Keeps relevant sound and speech

Technical measures of 2 Serenity Choice products (Music and Comfort) and 6 competitor products (all passive, in-the-ear, non-custom) confirmed that attenuation levels of Serenity Choice are lower than most other forms of hearing protection on the market and the frequency spectrum of the attenuation is relatively flat (Figure 2). These measurements were performed on KEMAR (Knowles Electronics Manikin for Acoustic Research) – an artificial head. They show the attenuation performance of different products relative to the open ear without protection. This aims to keep relevant

sound and speech and therefore allows situational awareness and communication. The frequency spectrum of the Serenity Choice Music is particularly flat in order to keep the sound of music as natural as possible.

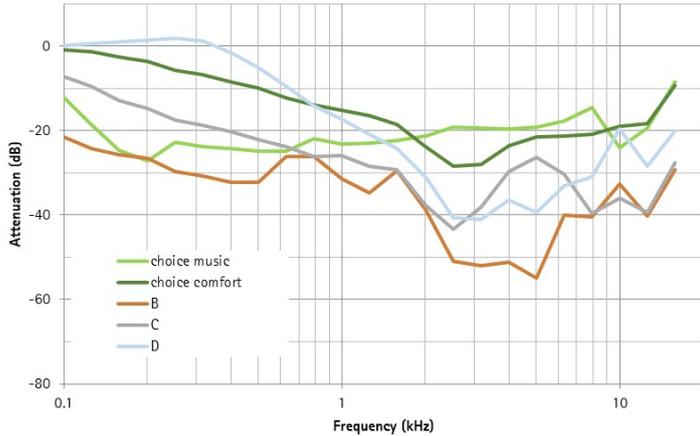


Figure 2. Attenuation curves of Serenity Choice Music, Serenity Choice Comfort and 6 competitor products (A, B, C, D, E and F).

Best music quality

A subjective sound quality study was conducted using Serenity Choice Music and the same 6 competitor products from Figure 2. The test stimulus was a 22 second snippet of music (Natalie Cole and Ray Charles – "Fever"). Recordings for each pair of hearing protectors were made on KEMAR equalized for free field presentation through headphones. A reference recording was also made with no hearing protection inserted and the reference recording was reduced in volume by 15 dB to be more aligned with the hearing protection products with regards to volume. A MUSHRA tool according to the ITU (International Telecommunication Union) recommendation ITU-R BS.1534-3 (2015) (Sonova SoundSurvey) was used for participants to listen and rate all of the recordings (blindly). They were asked to rate each recording on a continuous rating scale with anchor points at either bad, poor, fair, good or excellent. There were two different groups of participants – an expert listener panel consisting of 27 participants who had previously completed a training on sound quality assessments. The other group of 37 participants had had no experience of listening tests. Figure 3 shows the average

scores of the sound quality rating for the two groups of participants.

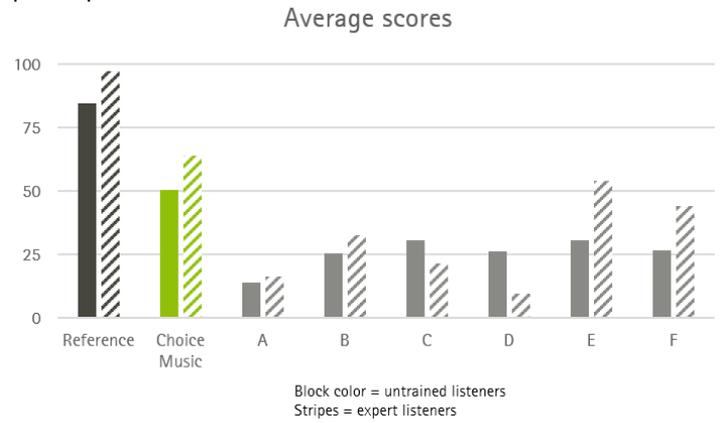


Figure 3. Sound quality rating of Serenity Choice Music and 6 competitor products. Results are for both groups of participants. A score of 0 corresponds to the label "bad" and 100 corresponds to "excellent". Serenity Choice Music outperforms all the competitor devices with high significance ($p < 0.01$) except from the product "E" for expert listeners.

The untrained participants rated Serenity Choice Music significantly better than any of the competitor products. The expert listener participants also rated Serenity Choice Music as better than all competitors. This difference was significant for all competitors apart from one (Competitor E). Figure 4 shows the correlation between the spectral variance (displayed in Figure 2) and the average sound quality scores for the different products. It can be seen that products with a balanced and flat frequency response i.e. a low spectral variance, tend to result in a higher sound quality score. In addition, it can be seen that the correlation coefficient $R^2 = 0.84$ for the trained listeners is much higher than the $R^2 = 0.44$ for untrained listeners. This indicates that the expert listeners responded more consistently across the different conditions and their quality rating can be well described with the straight forward model of spectral smoothness for the attenuation characteristics. This is a reasonable finding because a natural acoustic transparency is characterized by a flat frequency response.

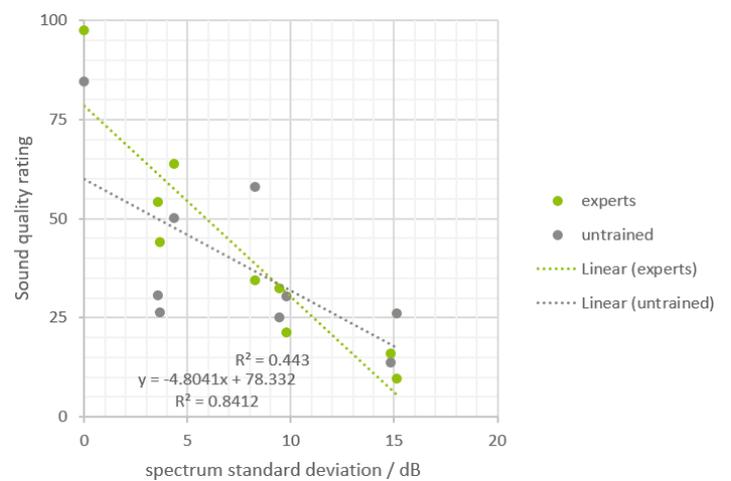


Figure 4. Correlation between expert rating and spectral variance for different ear protection devices.

Lets the ear breathe

Gray et al. 2005, has shown that the range of relative humidity of normal, healthy ears is 40 –70%. When the relative humidity rises above 70% the ear seems predisposed to discharge and infection. Therefore, the ideal hearing protection, should allow water vapor to escape in order to prevent moisture build-up in the ear.

Internal studies have been done to assess the breathability of the filters used in Serenity Choice. A special measurement tool was constructed that can be inserted in the ear. This device measures the relative humidity in the ear for a given time interval. Different Serenity Choice filters can be inserted into the device. The filters are the only passageway for moisture to pass in or out of the ear. For each participant, the first step was to measure the in-ear humidity with a full block filter installed. Then the other filters were installed one-by-one in the humidity sensor and kept there until the value of the humidity stabilized. This relative humidity value was then recorded. The humidity in the lab was also measured.

Results found that all of the filters tested showed breathability. The resulting relative humidity when using a filter was always lower than when the earplug was fully blocked. Filters containing only a mesh are most breathable. In Figure 5, we see the relative humidity of mesh filters, such as in the Motorsport and Work product, an impulse filter such as that used for the Shooting and Hunting product and a full block earplug with no filter. These results are from the female participants. Results from male participants showed a similar pattern.

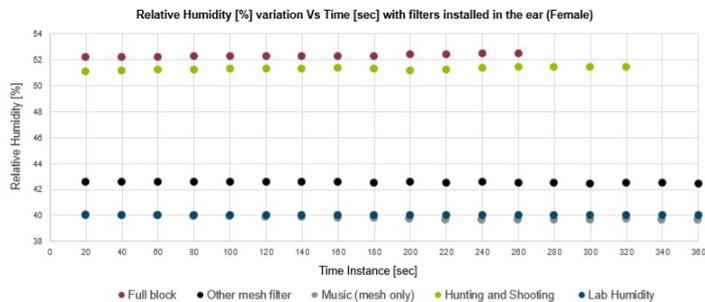


Figure 5. Relative humidity of mesh and impulse filters.

We can see that all products with filters have lower humidity levels than when a full earblock is used. Impulse filters (for hunting) were found to show the least breathability although the humidity was still less than when the earplug was fully blocked. This is likely to be because the impulse disc has a tiny hole in it for ventilation purposes. The mesh filters were found to have very low relative humidity levels which indicate high breathability. The mesh filter with the lowest attenuation level (Music, low attenuation, acoustic filter) was found to have a very similar humidity level to that of the outside environment, indicating that it is extremely breathable.

Figure 6 shows comparison of breathability of filters which contain a membrane + mesh. These results are from the male participants. Results from female participants showed a similar pattern. The breathability of a filter is determined by several factors and one factor is the thickness of the membrane. You can see in the graph that all filters again showed lower relative humidity levels than the full earblock. The Music filter with high attenuation (thickest membrane) is the least breathable of these filters tested. The other filters tested here (music with medium attenuation, Fly and Comfort with low attenuation) all have a thinner membrane and were found to have very low humidity levels.

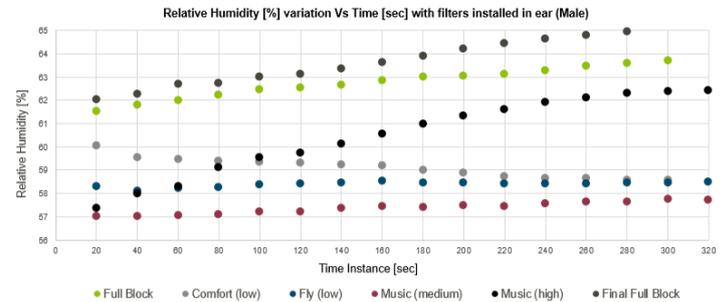


Figure 6. Relative humidity of mesh and membrane filters. The relative humidity in the lab during measurements was 54–56%.

Conclusion

Many people who are at risk of hearing damage due to noise don't wear hearing protection. Serenity Choice hearing protection products from Phonak are available through the client's preferred method of buying – the HCP. They meet the needs and wishes of the hearing protection client by protecting their hearing against damaging sounds whilst keeping relevant sound and speech. The Music product has been proven to outperform competitors with regards to sound quality and all filters have been shown to allow for ventilation of the ear.

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