

Epoq study measures user benefits

By Lise Bruun Hansen

This article summarizes the findings of a study designed to measure user benefits provided by Epoq, a high-end hearing instrument manufactured by Oticon. It is designed for persons of any age and lifestyle who have mild to moderate hearing loss.

The product is based on 10-kHz bandwidth platform technology. With its open fittings, including receiver-in-the-ear (RITE) styles, and wireless synchronization of settings and processing in the two hearing instruments, Epoq is designed to enhance sound quality, speech intelligibility, and spatial hearing. In its focus on spatial hearing, a new area in the hearing industry, it seeks to improve the patient's ability to use the natural cues to spatial organization (for more information, see Behrens 2008¹).

The device simultaneously detects and decides bilaterally which settings and processing are best for a given listening environment. The synchronized features are: the binaural compression scheme SpatialSound, noise reduction, directionality, My Voice, and feedback cancellation. Epoq is also designed to optimize settings automatically for various environments by learning from, for example, how the wearer uses the volume control. Along with being a hearing aid, Epoq is also used as a wireless headset, which connects to Bluetooth devices via the Oticon Streamer.

THE FIELD STUDY

Objective

The field study was designed to evaluate anticipated user benefits from Epoq, including immediate acceptance of the fitting, better speech intelligibility, improved sound quality, and enhanced spatial perception. The overall purpose was to verify the Epoq hearing system as a whole, reflecting the interaction among the features mentioned above. The study used existing advanced hearing aids, mostly Oticon Syncro, as benchmarks.

Set-up

The study, conducted in Denmark, consisted of real-life testing for at least 4 weeks plus an objective speech-in-noise test, the Danish sentence test Dantale II.² During the test period the participants were asked to use only Epoq. Questionnaires were used to assess their subjective experiences with Epoq compared with their own hearing aid. Each subject's hearing aid was evaluated just before the start of the test.

Subjects and devices

Fifty-eight experienced and satisfied adult hearing instrument users with mild to moderate sensorineural hearing

loss participated in the field trial. The group had a mean age of 72 years with a range of 28-84 years. The gender distribution was 62% males and 38% females. All were fitted bilaterally with Epoq in prescribed settings and with prescribed vent sizes or domes. All Epoq styles were represented, but the instruments had "no-name" shells and were referred to as the "test instrument." Most (82%) of the subjects owned either Oticon Syncro or Delta (the majority Syncro), which served as the reference instruments. Generally the distribution of styles and prevalence of directionality were equal for the reference instruments and test instruments.

RESULTS AND DISCUSSION

Time for acceptance

One goal of Epoq is spontaneous acceptance of individually prescribed settings. This field study found that the instrument was perceived positively as soon as it was fitted and that very little fine-tuning was needed. Among common descriptions of the sound were: "more sound," "clearer," "more natural," "certain of where the sounds come from." After wearing the test product for a week, participants were asked if they had become used to its sound and, if so, how soon that had happened (see Figure 1).

The study found that after a week's usage 91% of subjects had become used to the new sound. In fact, 78% said they had got used to the sound as soon as they were fitted. A few reported needing a little time—9% "a few days" and 4% "a week." The quick acceptance of the product was consistent with the objective and subjective evaluations done at the end of the trial.

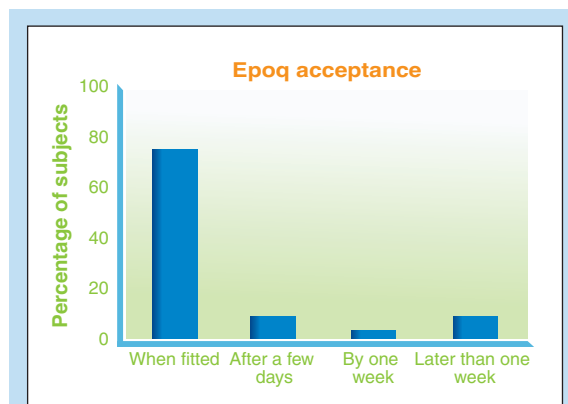


Figure 1. Distribution of subjects (in %) regarding how much time they needed to get used to the Epoq sound. *N*=58.

Speech understanding

Hearing instrument users always hope for better speech understanding in noise and in complex listening situations. To determine Epoq's effectiveness in this area, several evaluations were done, including the Danish sentence test Dantale II,³ which was used to test speech recognition in noise. The speech level was varied to find the SNR for 50% correct word score. Speech was presented from 0° and the uncorrelated party noise (75 dB SPL) was simultaneously presented from 110°, 180°, and 250°.

The test was carried out on subjects' own hearing instrument and Epoq in its final settings, i.e., including possible learned and fine-tuned settings. Testing, which was randomized across subjects, showed a significant benefit for Epoq over the subjects' own high-end hearing instrument (see Figure 2). The average improvement of 1.4 dB in speech-to-noise ratio found with the device corresponds to an approximately 15%-17% improvement in speech understanding in very difficult listening situations. These objective findings were supported by information from interviews and ratings in questionnaires. They also suggest the effectiveness of the device's new platform technology, audio bandwidth, and processing, including an optimized directionality scheme.

Spatial hearing

Complex listening situations in daily life were evaluated by means of the Speech, Spatial and Qualities questionnaire,⁴ also known as the SSQ. This is a relatively new, but well-documented tool that can be used to assess user performance in complex environments. Participants rated how well they did in different complex daily life situations with their own hearing instrument and with Epoq. Since the focus was on items closely related to spatial hearing, a subset of 17 items of the original SSQ was used representing all three sections (speech, spatial, and qualities). Figure 3 shows the average ratings within each section.

Within the order of magnitude of one point on a 10-point scale,

the 58 participants rated Epoq significantly higher than their own hearing instrument ($p < 0.05$). Here are examples of questions about hearing in difficult situations in which most subjects found the test instrument worked better than their own hearing aid:

"You are with a group and the conversation switches from one person to another. Can you easily follow the conversation without missing the start of what each new speaker is saying?" (Speech); "Do you have the impression of sounds being exactly where you would expect them to be?" (Spatial); and "Can you easily ignore other sounds when trying to listen to something?" (Qualities).

The findings suggest that the features in Epoq designed to improve spatial hearing, i.e., binaural compression, increase in bandwidth, open fittings, and improved hearing instrument acoustics, can help

improve access to the acoustical cues used for navigating spatial complexity.

The significant average improvement with Epoq over own high-end hearing instrument measured with SSQ is comparable to the perceived improvement when going from one hearing instrument to two hearing instruments, as reported by Noble and Gatehouse.^{1,5}

Sound quality

At the end of the trial the participants were asked whether, if they were permitted to keep the test instrument, they would prefer to continue using it or if they would rather go back to using their own hearing instrument. The large majority selected Epoq. A few had no preference and 5 persons (9%) said they preferred to use their own hearing aid. Among those who preferred their own instrument were two Delta users for whom the design was a top priority.

The subjects were definite about their preferences, giving them on average a score of 8.2 on a 10-point scale in which 9 corresponded to "very sure." Of course, as in any trial, the participants' preferences may reflect "a halo effect" in favor of a new product over the one they have. However, in accordance with the initial test instruction, the participants did not know that it was a real option to keep Epoq.

When the participants who preferred Epoq were asked why, the unprompted answers were various. However most often they referred to better sound quality, e.g. "more open sound," "more natural," "clearer," "more comfortable," "more detailed," "fuller," and "more sounds." Epoq was described as offering clear yet comfortable sound quality.

The second most often mentioned reason for choosing Epoq was related to better speech understanding, including communication in complex listening situations, such as family gatherings or outdoor activities. Greater physical comfort, especially with the RITE design, was another common reason for preferring the test instrument.

The wireless technology was also regarded as an advantage both in respect to button operation and

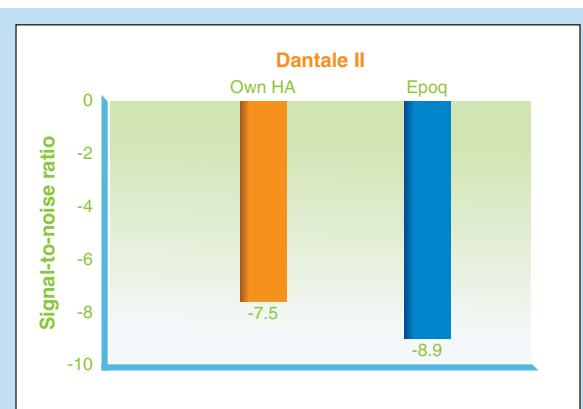


Figure 2. Mean signal-to-noise ratios for 50% correct word score in the Dantale II sentence test with own hearing aid and Epoq. $N=58$.

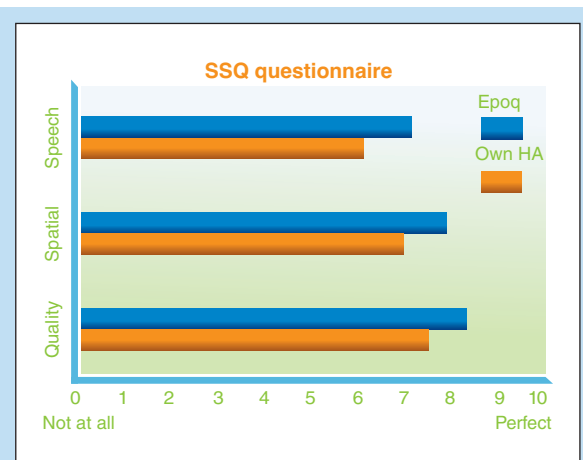


Figure 3. Average scores of all items on each specific section of the SSQ questionnaire: Speech, Spatial, and Qualities. $N=58$.

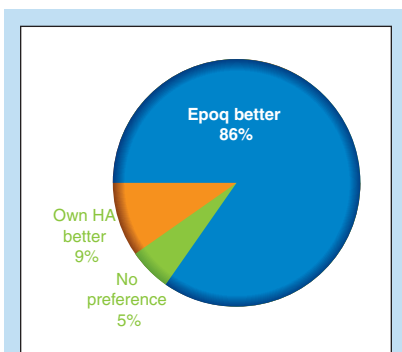


Figure 4. Distribution of subjects responses (in %) when they were asked which hearing aids they would prefer to use if they had a choice. $N=58$.

connectivity to Bluetooth devices, especially mobile phones, via Oticon Streamer.

The SSQ questionnaire showed that Epoq performed better in the study in complex listening environments by facilitating the spatial perception and segregation of sounds. Although a few participants directly mentioned better ability to locate sound or to distinguish between sounds, this was not a typical unprompted reason for their preference. Why is that? Most likely it is

because those of us with normal hearing are unaware of the spatial hearing we do all the time and so we don't have the language to describe it. In addition, the benefit of spatial hearing is embedded in better speech understanding in complex situations. So, for example, the comment "hearing more sounds" could be a way of expressing better spatial hearing.

CONCLUSION

Epoq proved beneficial for test subjects with mild to moderate hearing loss by improving the intelligibility of speech sounds in noise as well as providing better spatial hearing in complex listening environments. The sound quality was perceived as more natural, clearer, and comfortable. A significant percentage of the participants accepted the sound of the test instrument immediately and by the end of the trial the great majority preferred Epoq overall to their own high-end hearing instruments.

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