Speech-in-noise testing still provides value when fitting the latest technology

It is well known that the number one complaint of patients with hearing loss is difficulty understanding speech in noise (Kochkin, 2012), although the degree of challenge varies from patient to patient. As part of the commitment to helping patients better understand speech in noise, Unitron offers a multi-destination automatic program to help them really focus on conversations in this universally challenging listening environment. However, even having the latest and greatest hearing instrument technology doesn’t guarantee perfect results for every patient. Hearing healthcare professionals need to counsel each patient to create realistic expectations around the amount of improvement they can expect from amplification. Speech-in-noise (SIN) testing is a best practice tool for objectively measuring the degree of benefit the technology is providing. The results can then be shared with patients to reassure them that their main complaint is being addressed.

This whitepaper outlines the results of a recent field trial study where participants with varying degrees of hearing loss were given the two most common speech-in-noise tests: the QuickSIN™ and the BKB-SIN™. It clearly demonstrates that collecting data on hearing instrument performance in speech in noise helps to pinpoint issues and find solutions so patients can feel fully confident with how their hearing instruments perform in their day-to-day lives.

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Favorite sound: wind chimes
The case for performing speech-in-noise testing

According to McArdle (2009), speech-in-noise performance should be measured since it can't be predicted using audiometric data or speech testing in quiet. McArdle also recommends SIN testing because it addresses the main complaint of patients and provides information on the distortion component – something pure tone testing alone can’t do.

Despite all of this, a survey conducted by Strom (2003) found that fewer than half of dispensing professionals use any type of speech-in-noise test. This is unfortunate when you consider the many benefits associated with this type of testing:

• It reduces repeat office visits (Kochkin, 2011).
• It is one of the top ten reasons for hearing instrument delight (Rogin, 2009).
• It requires minimal clinical time, yet helps to build rapport, justify treatment and improve device and setting selections (Beck & Nilsson, 2013).

In order to further explore the benefits of SIN testing, Unitron conducted a field trial study to determine the extent to which SIN testing can quantify hearing instrument benefit and either challenge or complement a patient’s subjective perception of their experience with amplification.

About the study

The field trial study consisted of a group of nine participants exhibiting varying degrees of hearing loss. It measured the range in hearing instrument performance for each participant using the QuickSIN and BKB-SIN tests. By comparing the SIN test results with patients' subjective reports around their experiences during take-home trials with the same hearing instruments, we are able to assess how individual perceptions of hearing instrument performance in speech in noise compare to actual clinical performance. Note that we did not perform a comparison of hearing instrument technology level due to the size of the participant pool.
The participants

Each participant wore a hearing instrument from Unitron’s new North platform featuring SoundNav, the multi-destination automatic program with multiple environments to address different levels of background noise.

Styles – Participants were assigned to wear one of two behind-the-ear (BTE) hearing instruments: earhook with earmold or slim-tube with dome.

Fitting formula – The default fitting formula used was NAL-NL2.

Age range – Participants ranged from 62 to 81 years of age.

Hearing loss range – Please refer to the graphs in Fig. 1 and Fig. 2.

Fig. 1 – Audiograms (right ear)

Fig. 2 – Audiograms (left ear)
The tests

Each participant was administered the BKB-SIN and QuickSIN tests under two conditions: unaided and aided. Both of these SIN tests are easy to use, offering short administration times. Both tests are also sentence-based, which means they provide information on performance in conversational speech in the presence of background noise – an environment that is closely related to experiences encountered frequently in daily life.

Tests were administered using a typical clinical setup, with materials presented using Windows Media Player, routed to GSI 61 audiometer.

While memory or other cognitive issues can be a confounding factor in sentence-based test results, this was not likely to be an issue with the participants in our trial. Although cognitive ability was not specifically measured, none of the participants demonstrated difficulty completing any of the tasks associated with the standard clinical trial that would suggest an influence on their results beyond hearing loss.

**Test 1: QuickSIN** – Participants were presented with 6 IEEE (Institute of Electrical and Electronics Engineers) sentences, delivered by a female speaker in the presence of four-talker babble. The sentences were presented from 25 to 0 dB signal-to-noise ratio (SNR), in 5 dB decrements. The speech and noise were both presented at 0 degree azimuth. Patients were asked to identify key words in the sentences, resulting in a score converted to SNR loss.

**Test 2: BKB-SIN** – Participants were presented with 10 sentences, delivered by a male speaker in the presence of multi-speaker babble. Speech was presented at 0 degree azimuth and noise was presented at 180 degrees azimuth. Patients were asked to identify key words in the sentences, resulting in a score converted to SNR loss.
Take-home questionnaire results

Ratings were averaged across four classes of speech-in-background-noise environments:

- Loudness of speech in both quiet and background noise situations. Ratings range from 1 to 7, with 4 representing comfortable loudness.

- Clarity of speech in both quiet and background noise situations. Ratings range from 0 (very unclear) to 10 (very clear).

- Total impression overall of speech. Ratings range from 0 (very bad) to 10 (very good).

- Satisfaction with the overall wearing experience. Ratings range from 0 (very unsatisfied) to 10 (extremely satisfied).

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<tr>
<th>Participant ID</th>
<th>Age</th>
<th>Loudness (1 to 7)</th>
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<th>Total Impression (0 to 10)</th>
<th>Satisfaction (0 to 10)</th>
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Speech-in-noise evaluation

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<th>Participant ID</th>
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<th>BKB-SIN Unaided</th>
<th>BKB-SIN Aided</th>
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Participants TS-03 through TS-10 were open fits. Participants TS-12 through TS-15 were standard earmold fittings.

* indicates that the participant was a first-time hearing instrument wearer.
Results

In general, performance across all participants varied, yet most showed improvement on both SIN tests. Ideally, we want SIN tests to demonstrate measurable improvement in an unaided versus aided condition and this was the case for most participants.

- Two participants (TS-09 and TS-10) performed worse on the QuickSIN in the unaided versus aided condition. However, these participants showed significant improvements in the BKB-SIN performance.

- One open-fit participant (TS-07) exhibited a ceiling effect, where unaided QuickSIN performance was so good that there was no room for improvement in the aided condition. This could give the impression that the participant doesn't require amplification. However, this participant’s BKB-SIN test results revealed difficulty in poor SNR conditions, which indicates that amplification can and did provide benefit. This participant’s ratings for sound quality and satisfaction were also positive.

- Only one participant (TS-14) showed little-to-no improvement on either the BKB-SIN or QuickSIN. In spite of this finding, this participant exhibited high ratings on the take-home trial for sound quality in both quiet and speech-in-noise environments. So the perception of benefit was clearly present. There are two probable reasons for this discrepancy:

  1. This participant had very poor unaided scores, which would indicate a high probability of continuing to experience considerable difficulty understanding speech in situations with background noise.

  2. This participant also had a moderate to moderately severe hearing loss, indicating that perhaps there is a greater distortion component that amplification simply can’t overcome.
When perceptions don’t match reality

The participant (TS-15) with the lowest satisfaction and sound quality ratings during the take-home trial actually showed improvement in aided versus unaided conditions for both tests. This finding is significant for several reasons:

• The participant’s only comments were that they repeatedly needed to make volume control adjustments, indicating that their negative perceptions were related to volume.

• Although the subjective reporting on hearing instrument performance was negative, the objective measurement using SIN testing showed that the participant did experience benefit from wearing the hearing instruments in speech-in-noise environments.

• In a traditional clinical setting, a hearing healthcare professional could use this SIN test data during counseling to clearly show how a patient’s perceptions are a mismatch with reality. This opens the door to discussing options for achieving results that will satisfy the patient subjectively, such as fine-tuning adjustments (likely appropriate in this case) or correcting poor earmold fits.

• This participant’s experience is a perfect example of how having actual test results can keep the conversation open. Although some adjustments need to be made, which is the typical process with any fitting, there is definitive proof that the hearing instruments are working to provide benefit. Once the data has established this fact, the hearing healthcare professional can then work with the patient to set realistic expectations as to what amplification can and can’t achieve.
Discussion

The Unitron field trial study discussed in this whitepaper was conducted as a learning exercise. Even though the participants all shared the similarity of wearing the latest hearing instrument technology, we could not accurately predict performance for the group. We can take away several key learnings from the study results.

**More is better** – The purpose of the study was not to establish the superiority of one SIN test over the other. In fact, the results clearly demonstrate cases where a participant experienced little to no improvement with one test, yet considerable improvement with the other. This would suggest that having more than one SIN test on hand for demonstrating objective hearing instrument benefit to patients is useful.

**No two patients are alike** – Overall, the range in hearing instrument performance uncovered by the SIN testing in the study underscores the fact that no two patient experiences are alike. Even if two patients are wearing hearing instruments with the latest technology, their experiences and perceptions can be very different.

**Tempering perceptions with reality** – A patient’s subjective experience of hearing instrument benefit can also be at odds with actual benefit. By assessing SIN performance, hearing healthcare professionals can quantify the amount of improvement and share that information with patients to uncover discrepancies between perceived and actual benefit. The testing provides insights that can be used as a segue into meaningful conversations.

**Establishing a baseline** – SIN testing is a great way to establish a baseline to understand whether a patient’s hearing instrument performance is actually decreasing over time. It can also be used with patients who feel as though their new hearing instruments aren’t working as well as the old ones. Having baseline test results in place allows hearing healthcare professionals to easily identify whether the issue is truly with the hearing instrument performance or the patient simply needs modifications and more time to adjust.
Summary

There is a certain component of the auditory system for which we simply can’t predict performance. Speech understanding in noise is a challenging listening environment for all patients, but each person’s experience of amplification in this environment is unique, even with the most cutting-edge hearing instrument technology. Continually using the latest technology to address patient needs is a good practice, but it’s only a part of the whole solution.

The inability to predict speech-in-noise performance makes it difficult to counsel patients on how well hearing instruments will address their main complaint. That’s why following the best practice of using standardized SIN testing is so powerful. It lets hearing healthcare professionals put patients’ subjective reports of hearing instrument performance in perspective by objectively measuring the degree of benefit the technology is providing. This data can then be used to set reasonable expectations around what amplification can do for the patient, keeping their minds open and the conversation flowing.

References:


At Unitron, we care deeply about people with hearing loss. We work closely with hearing healthcare professionals to provide hearing solutions that improve lives in meaningful ways. Because hearing matters.