How to Integrate Listening and Auditory Communication Enhancement (LACE) Into a Clinical Practice

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Listening and Auditory Communication Enhancement (LACE) is an inexpensive, interactive computer program designed to engage the adult hearing impaired listener in the hearing aid adjustment process, provide listening strategies, build confidence, and address cognitive changes characteristic of aging. It can be self administered at home, or in a clinical setting. Despite the low cost of LACE, there are many audiologists who believe they simply don’t have time or understanding to introduce the patient to the process. This manuscript provides a “how to do it” tutorial to illustrate how LACE can be applied to a clinical practice.

Few readers of this journal would argue with the notion that additional aural rehabilitation (AR) and auditory training (AT) beyond the use of wearable amplification plays a significant role in helping patients achieve their full communication potential. Despite the logic and growing body of evidence supporting this position, most audiologists do not offer or prescribe additional therapies, and most patients do not ask for, or even want to participate in, additional rehabilitation, if it is going to cost them additional time or money. There are several possible reasons for this resistance. From the patients’ perspective, they may have the unrealistic belief that hearing aids alone are going to solve all their communication problems and that they have already spent enough time and money in purchasing the device(s). From the audiologists’ perspective, there is the justifiable belief that there is a lack of adequate reimbursement. There is also, however,
the incorrect perception that there is a lack of evidence-based data supporting individual AR and AT. Countering this view were recent evidenced-based analyses of research on counseling based group AR by Hawkins (2005) and on individual adult AT by Sweetow and Palmer (2005). Sweetow and Palmer reported mixed results, suggesting that at least with synthetic training, improvements in communication strategies can be expected. Audiologists also may be reluctant to provide AR and AT because of the belief that such programs require an inordinate amount of time and effort to develop and conduct. Indeed individual training on a one-to-one basis can be both time- and cost-intensive. Fortunately, computerized AT alternatives are available.

Listening and Auditory Communication Enhancement (LACE), conceived at the University of California, San Francisco and produced by NeuroTone, Inc., is an interactive, adaptive AT program designed to provide listening strategies, build confidence, create auditory percept associations, and address cognitive changes characteristic of the aging process. LACE is intended for older teenagers or adult patients, with or without hearing loss, who report difficulty understanding speech in challenging listening environments. The therapy may not be appropriate for individuals with dementia or poor English language skills. Stimuli are at about an 8th grade English reading level; however, the topics are of interest mostly to adults. The content may or may not be appropriate for cochlear implant recipients. Plans are underway to create a version of LACE for cochlear implant wearers and in different languages.

Articles detailing the development of LACE as well as data supporting its effectiveness and factors impacting the outcomes are available (Henderson Sabes & Sweetow, 2007; Sweetow & Henderson Sabes, 2006). Despite the low cost of LACE to the professional and to the patient, there are many audiologists who report that they simply do not have the time or the understanding to introduce the patient to the process. The purpose of this manuscript is to provide the reader with a “how to do it” tutorial and to present some suggestions to illustrate how LACE can be applied in a clinical practice.

DESCRIPTION OF LACE

Since a major objective in rehabilitation is to enhance a hearing impaired patient’s communication abilities, an essential step is to improve listening skills. To do this the listener must address all the essential elements of communication including hearing, listening, comprehension, and communication (Kiessling et al., 2003). Hearing aids only address the hearing component. LACE addresses the other elements. It is primarily a “top-down” training program that utilizes realistic speech stimuli in an effort to strengthen cognitive and listening skills. The stimuli were recorded by male, female, and child speakers in order to promote generalization. LACE training is composed of three general categories of tasks: degraded speech, cognitive training, and interactive communication strategies.

Degraded speech tasks. Because of the difficulty hearing impaired individu-
als have discriminating speech in noisy environments as well as comprehending rapidly presented speech, the degraded speech exercises comprise the majority (about 70%) of the training exercises. There are three types of training drills within this category. In the Speech in Noise training, speech is immersed into multi-talker background noise babble. In the Rapid Speech training, speech is time compressed (to simulate rapid speech), and in the Competing Speaker training, speech is presented along with a single competing speaker. The patient is instructed to listen to and identify the signal (by repeating it aloud or silently). When deemed appropriate, the patient is instructed which voice (male, female, or child) to listen to. When ready, the patient requests a display of the correct response by selecting the NEXT button via mouse click or keystroke. If the patient indicates that he or she correctly identified all the words in the sentence, the signal-to-noise ratio (SNR) is changed (by 2 dB) and the next sentence will be a little more difficult. If the sentence comprehension was reported as being incorrect, the next sentence will be easier. In other words, the difficulty level of the task adapts based on the accuracy of the patient’s response to the previous task. This way, both boredom and frustration are minimized. Successful responses are rewarded with an immediate compliment (e.g., “good job”) while unsuccessful responses are followed by a gentle motivator (e.g., “keep trying”). Examples of the explanation for the task, instructions, and answer screens for the Speech in Noise task are shown in Figures 1-3.

**Cognitive tasks.** Many individuals with hearing loss, particularly the elderly, have diminished cognitive resources for speed of processing, working memory, and executive function (Kiessling et al., 2003). Cognitive skill training comprises about 20% of the training drills. There are two types of drills: missing word and word memory. In the Missing Word exercises LACE presents a sentence with one word blocked out by a sound effect. The trainee’s task is to quickly select a word that would logically fit into the sentence where the ob-

![Figure 1. Screenshot illustrating the explanation for the Speech in Noise task.](image-url)
scured word occurred. The purpose of this exercise is to demonstrate to the pa-
tient that English is redundant and that it is not necessary to hear every word in
order to understand the meaning. LACE scores the patient both on the correct an-
swer (which requires basic linguistic and contextual knowledge) and the speed at
which the patient responds. This exercise stresses the importance of making a
rapid decision and not dwelling on a part of the communication that was missed.
Examples of the explanation and answer screens for the Missing Word tasks are
shown in Figures 4 and 5.

For the Word Memory exercise, LACE first displays a single target word. A
sentence is then played containing the target word. The listener is asked to iden-

Figure 2. Screenshot providing instructions for the Speech in Noise task.

Figure 3. Screenshot from the Speech in Noise task showing correct answer and request-
ing a reply from the patient indicating whether or not the sentence (or gist of the sentence)
was correctly identified.
tify the word that occurred just before or after the target word. If the selected word is correct for two consecutive trials, the difficulty level of the next task increases by presenting the sentence prior to the display of the target word, thus forcing the listener to retain the entire sentence into short term memory. If the patient is successful twice in a row with that task, LACE will next present two target words prior to two sentences, then two sentences prior to two target words, and so on. Examples of the screens for the Word Memory task with two target words are shown in Figures 6 and 7.

**Interactive communication strategies.** Throughout the training, “pop-up” screens presenting helpful hints and strategies for coping with hearing loss and difficult listening situations are offered. There are over 200 such screens provided by LACE. The screens have been prioritised so that the suggestions most

![Figure 4](image-url) **Figure 4.** Screenshot providing an explanation for the purpose of the Missing Word task.

![Figure 5](image-url) **Figure 5.** Screenshot illustrating notification of an incorrect answer on the Missing Word task.
relevant for acclimatization to amplification are presented during the first several days of training. These Helpful Hints are designed to provide patients with realistic expectations and keep them motivated. Several days into the training LACE will begin to add Communication Strategies which are more general suggestions for overall approaches to augment communication. Examples of these Interactive Communication Strategies screenshots are shown in Figures 8 and 9.

**Who should use LACE?** LACE is appropriate for English speaking adults and older teenagers who perceive difficulty understanding speech in quiet or adverse listening conditions. It can be used regardless of degree and configuration of hearing loss, though the signals must be at least partially audible to the trainee so patients with profound loss may not be able to benefit.

**When and how often should the training be done?** LACE contains 20 30-min
training sessions. Patients are encouraged to do the training 5 days a week for 4 weeks, however benefits can be obtained from as few as 3 or 4 sessions. Occa-
sional training days can be missed, but users should not miss extended (more than 4 or 5) consecutive days. For patients who wish to continue training past the 20 sessions, a simple phone call will allow the registration to be reset for additional sessions. LACE should be used when the user is alert and free from distractions.

VERSIONS OF LACE

At the time of this writing LACE is available in three different versions. LACE Home Edition (HE) is presented on a CD for use on a PC or Macintosh computer in the privacy of the patient’s home. LACE Clinical Edition (CE) is de-
signed for use on a shared PC provided by the audiologist. The CE version is in-
tended to be used by multiple patients, either in the Audiology clinic or via a lap-
top computer loaned or rented from the audiologist. A LACE DVD was released

Figure 8. Helpful Hint screenshot.

Figure 9. Communication Strategy screenshot.
in the summer of 2008 for use by patients who do not own computers or have ade-
quate computer skills. This version is very similar to the computer LACE, how-
ever it does not presently have the capability to transmit performance data elec-
tronically to the audiologist. Initial data from NeuroTone (personal communica-
tion, June, 2008) suggests performance is similar for the CD or DVD versions.

**LACE HE**

LACE will run off of almost any computer purchased since 2000. The specific system requirements to run LACE are as follows:

- PC or Macintosh computer with a minimum 256 MB of RAM, 150 MB of free hard disk space, and a speed of at least 400 MHz.
- CD-ROM drive.
- Screen resolution of at least 800 × 600, although it is recommended that a resolution of 1024 × 768 or higher be used.
- Operating system – Windows 2000, Windows XP, Windows Vista, or a Mac running OSX 10.4 or newer.
- Internet connection – a broadband connection is recommended but a dial-up connection is sufficient.
- Reasonable quality speakers – most desktop speakers will suffice but many laptop speakers are of low quality, so it is advisable to instruct the patient to connect external speakers to the system.

*Figure 10. Listening and Communication Enhancement Clinical Edition (LACE CE) office version keypad, software, and cable.*
LACE CE

LACE CE is the multi-user version of LACE designed to be used on a computer provided by the audiologist. LACE CE has an office mode and a mode designed for use on a loaner laptop computer. In office mode, an administrator manages the computers in the office or clinic that offers LACE CE. The administrator has a password to start the program, and has the ability to add new users or continue existing sessions for patients. Data privacy is monitored by supervising the computer usage. LACE CE includes a pair of MSL Auditory Reference speakers. Operating requirements for LACE CE are the same as listed above for LACE HE, except that LACE CE is not currently available for Mac operating systems. LACE CE also contains a special keypad with large buttons and lighted LEDs for patients who have difficulty with standard computer keyboards. The special keypad and accessories are shown in Figure 10.

Loaner mode can be used on laptop computers that are loaned from a clinic to a single user for the training sessions. Loaner mode provides a Purge tool to erase all data once the user completes the training to ensure patient confidentiality. Since it is unlikely the patient would have an internet connection, the audiologist will have to register LACE online at the office prior to having the patient take home the unit for training. Detailed instructions regarding installation and use of LACE CE is beyond the scope of this paper but can be found on the Neurotone web site.

INTEGRATING LACE INTO A CLINICAL PRACTICE

Despite the desire to provide home based AR and AT, some audiologists have been reluctant to try LACE because of concerns that it may require too much of their already burdened time. To dispel this perception, the following tutorial is offered for the effective utilization of LACE.

Getting started – What the audiologist needs to do. First, an account must be established. Log on to www.neurotonepro.com. This is a secure, Health Insurance Portability and Accountability Act (HIPAA) compliant web site that will allow the professional to purchase LACE, view and create patient records, download marketing materials, and find pertinent research articles. Once on the site, click the Register Now link. Enter the e-mail address and then click on the Register Now button. An e-mail will be sent to the e-mail address entered. Click the Choose Account Password link found within the confirmation e-mail. Enter the required information and click Complete Account Setup.

The next step is optional, since it is not required for the patient to use LACE, but is highly recommended because it will allow the audiologist to remotely monitor the patient’s progress. To create a Patient Record, click on the NeuroTone web site link Create Patient Record. Input the identifying data, such as the pa-
tient’s name and age, along with the patient’s 12 digit Registration Number (which can be found on the patient’s LACE CD package sleeve) and then click on Create Patient Record. Results from other outcome measures such as the QuickSIN, Hearing Handicap Inventory for the Elderly (HHIE), and so forth deemed appropriate can be entered by clicking on the link that says Optional Information.

Clinics achieving the greatest reduction in returns routinely use the NeuroTone Pro web service to monitor patient progress. Some busy professionals, however, do not have the time to access each individual patient record, check uploaded training progress, and communicate with the patient. An Automated Patient Email Service is available that instructs NeuroTone to send automated e-mail reminders using the audiologist’s or clinic’s name, to patients encouraging them to begin their LACE training or resume it if they have been inactive. To enable this service go to the Email Alerts link in order to set e-mail reminders for patients and to have e-mail reminders transmitted to the audiologist. The text of the automated e-mails also can be modified here. Next, go back to the Email Alerts page and click on the Email Reminders for You link. Check the box that says Send email alerts and then select the e-mail address to which these alerts should be sent. When activated, this tool will automatically transmit an e-mail notice when a patient has been inactive with LACE training. Other features of the automated e-mails also can be modified. For example, the number of inactive days required before a reminder for the patient to continue their training will be sent can be set; the text of the e-mails that will be automatically sent to the patients can be individualized, and the name and e-mail address that the patients will see when receiving the automated e-mails can be set.

The Automated Patient Email Service requires signed consent from the patient before it can be used. There is a consent form in each LACE packet. When the patient receives a new LACE CD, have him or her, the patient, fill out the E-mail Consent Form. Enter the patient’s e-mail address under the E-mail Alerts entry field along with the registration number found on the patient’s LACE CD. After that, the patient will receive a welcome e-mail, a reminder e-mail when training has taken too long to begin or continue, and an e-mail to encourage them to keep going. If access to a computer at the time of dispensing the LACE CD to the patient is not available, simply write down the pertinent information on the LACE Registration Number Log that is contained in the LACE packet. Regardless of whether the automated e-mail service is utilized, it is most useful to follow up with a phone call to the patient a few days after dispensing LACE.

Encouraging patients to use LACE. Martin (2007) and Sederholm (2007) have published papers describing the integration of LACE into their busy clinical practices. Inherent in both of their practices, which have experienced noteworthy reductions in hearing aid return for credits since starting LACE, is the fact that they present LACE to their patients as a mandatory aspect of the auditory
communication recovery process. When they dispense new hearing aids, they automatically distribute LACE to the patient and counsel that it is an integral part of the program. For those patients who do not own computers or who are not computer literate, LACE CE is offered as an alternative.

For the cynical, reluctant, or somewhat disinterested patient, it may help to emphasize the difference between listening and hearing. Remind the patient that many people with normal hearing may be less than perfect listeners. This is because while hearing can be a passive action requiring only an intact auditory system, listening is an active process requiring attention, focus, and the intent to communicate. It should be stressed that hearing aids alone will not solve all the communication problems. It is also necessary to retrain the brain both to listen to the speech that hearing aids will allow them to hear and to complete the message that the hearing loss did not allow them to hear. If a patient appears hesitant to use the LACE program, provide assurance that it is a user-friendly process that has been successfully utilized by patients from 16 to 95 years of age.

It may also help to use the physical therapy analogy. Few patients balk at a surgeon’s instructions to engage in physical therapy following repair of a knee or rotator cuff. The physical therapy is important to strengthen and engage the muscles surrounding the surgical area and to help the patient (and the patient’s brain) reintegrate the formerly injured joint into action. Inform the patient that keeping the brain sharp is likewise essential for communication. Many of the exercises contained within LACE are designed to help the patient focus memory and maximize cognitive skills. Remind the patient that new hearing aids are a significant monetary investment, and it is important to take advantage of every opportunity to maximize potential. In addition, instruct the patient that LACE provides important communication strategies and hints that are designed to be particularly helpful during the trial or adaptation period.

A 3 min LACE instructional video can be downloaded from the web site that reinforces these concepts. The audiologist does not have to be present during this viewing. It also helps to have the patient’s communication partner present for this counseling and video. Then, it is helpful to have the patient view the demonstration of LACE, also downloadable from the www.neurotonepro.com web site. While it is not mandatory for the audiologist to be present during this 10 min demonstration, questions may arise, so having someone available who is familiar with LACE can be very beneficial. This author utilizes an audiology assistant or administrative assistant for this function.

**Getting started – What the patient needs to do.** LACE is very easy for patients to install on their home computers. When the CD is inserted, the patient is prompted to enter the 12 digit registration number located on the sleeve of the disk. After a welcome screen and a short introduction video, the patient is prompted to set the LACE volume control to their most comfortable listening level (MCL). Patients are instructed to set the MCL with their hearing aids on
(assuming they wear hearing aids) as if they were listening to the radio or TV for an hour, and also to train with the aids on. About 90% of the training exercises are presented at the patient’s MCL. About 5% are presented at +5 dB re MCL, and about 5% are presented at -5 dB re MCL in order to simulate the fact that in the real world speech isn’t always at the desired intensity level. Once the MCL is set, patients are told not to vary the volume control on their computer or hearing aids. Patients are also advised that the effectiveness of LACE is dependant upon them answering the questions honestly.

**Self tests.** Once the comfortable level is established, the patient will take the first of a series of daily standardized tests designed to accurately and fairly assess progress. An example of the tests used in LACE (v3.0 and higher) is the QuickSIN™ from Etymotic Research. The QuickSIN™ test is administered during Session 1, Session 6, Session 11, Session 16, and finally on Session 20. After

![Figure 11. Screenshot of a sentence on the Speech in Noise (Etymotic Research licensed version of the QuickSIN™) test.](image)

![Figure 12. Screenshot of Speech in Noise (QuickSIN™) results.](image)
each sentence is presented, LACE displays a screenshot as shown in Figure 11. At the completion of the test, LACE shows the patient the results in layperson friendly terminology (see Figure 12) rather than the more technical SNR loss familiar to audiologists. Each day, training begins with a different standardized test. Other tests currently available in LACE include a Rapid Speech test and a Communication Confidence Test (recently developed and validated at University of California, San Francisco). At the conclusion of the daily self-test (which takes about 5 min), the patient selects a topic for most of the day’s training exercises (some of the drills are not topic related). Among the current topics are hearing and communication, health tips, money matters, and U.S. Revolution. Other topics are periodically added to the list of choices. After selecting the topic, training proceeds (for approximately 25 min) on the various tasks. At the end of the session, the patient is prompted to save the data. The next day, the training begins where it ended at the previous session.

Feedback to the patient. Feedback regarding performance is absolutely vital for learning. LACE presents the user with information on his or her progress after each sentence, at the end of each training session, and weekly following the standardized testing. An explanation of the latter two methods follows:

1. Daily Training Task Performance Summary:
The LACE user is shown a summary of the day’s training at the end of each session – the message will say “keep trying” or “improved” based on the user’s progress. This method of training performance reporting allows users to keep track of their training progress in a simple, easy-to-understand format. At the end of each training session there will be a simple scoring table indicating whether the patient has improved or remained about the same relative to the previous session.

2. Weekly Standardized Testing:
In addition, each week patients will view the scores of the self tests so that they can gauge progress from the beginning of the therapy. An example of a graph showing progress on the standardized Rapid Speech Test is displayed in Figure 13.

*Figure 13. Screenshot of weekly progress based on standardized testing. In this example, the patient was tested on Sessions 3, 8, 13, 18, and at the end of training on Session 20.*
LACE records the trial-by-trial performance at each training session and reports it to a HIPAA-compliant database where only the registered audiologist can access the results. These data allow the clinician to observe the time the patient has spent on training, as well as any performance changes that have taken place over time, thus allowing for this information to be incorporated into counseling. To monitor training scores and history the audiologist logs on to the Current Patient Records’ link on the www.neurotonepro.com web site using a personalized password. The patients’ training scores will only be available if a Patient Record was created. No data will be shown until the patient has completed a full day of training.

The performance data available to the audiologist are presented in greater detail than what patients view in the LACE program. Audiologists have access to daily training data for each exercise (see Figure 14) as well as the self test results. The first day or two, changes on the daily training material may be related to pro-

Figure 14. Daily performance data on each of the exercises. Note that completely horizontal lines occur when the tasks are not completed each day, as well as when the scores were the same as on the previous day.

MONITORING AND AUDIOLOGICAL INTERPRETATION

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Figure 15. Screenshot of results from weekly QuickSIN™ tests. This patient was tested on Sessions 1, 6, 11, 16, and at the end of training on Session 20.
cedural as opposed to perceptual learning. After that, it is believed that the progress represents perceptual learning. The weekly measurements, however, are based on standardized tests that are not directly related to the training material. Therefore, it is assumed that changes on these measures also reflect generalization. An example of the weekly test results on the QuickSIN as measured in dB SNR loss is shown in Figure 15.

Note that the data shown in Figure 14 are further categorized by the presentation level, so the audiologist can gain additional insight into how the patient is functioning at various input levels. This may allow for refined strategies regarding amplification parameters. For example, if the patient shows significantly poorer performance at MCL than at +5dB re MCL, it would seem likely that the gain in the hearing aids needs to be increased. Also, there may be areas of particular improvement and areas where the improvement was minimal. This may be due to multiple reasons; perhaps this patient was performing at very high baseline levels in auditory memory, allowing less room for improvement, or perhaps this patient truly has a working memory deficit making this task particularly difficult.

As a reference, the average improvement after 20 training sessions reported in the 2006 Sweetow and Henderson Sabes data based on a multi-site study of 65 trained subjects is shown in Table 1. It is important to recognize that the difficulty level of training increases as the patient’s skill improves. Due to the adaptive algorithm, the patient will always get about half of the presentations incorrect, no matter how much improvement he or she has made. The training is based on finding the threshold for these tasks (like in a hearing test). Scores may fluctuate depending on baseline scores, subject matter, general interest of the content, and the attentiveness of the patient. The important measure is the overall trend of the scores.

Table 2 provides a general interpretation of trends and possible intervention strategies. Average improvement in this Table refers to the 2006 Sweetow and Henderson Sabes data. Certain other performance trends were reported by Hen-

Table 1
Mean Improvement after 20 LACE Training Sessions

<table>
<thead>
<tr>
<th>Improvement</th>
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<tbody>
<tr>
<td>3.5 dB SNR improvement in Speech in Noise</td>
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<tr>
<td>4.5 dB SNR improvement in Competing Speakers</td>
</tr>
<tr>
<td>10% compression ratio improvement in Time Compressed Speech</td>
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<tr>
<td>2 levels of difficulty improvement in the Target Word (auditory memory)</td>
</tr>
<tr>
<td>500 ms improvement in Missing Word (speed of processing)</td>
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<table>
<thead>
<tr>
<th>Training task</th>
<th>Scoring trends to look for</th>
<th>Patient counseling notes</th>
<th>Other considerations</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech-in-noise</td>
<td>A decrease in score indicates an improvement. The average patient has about a 3 dB improvement during training.</td>
<td>A normal hearing listener will have a score of about 2 dB SNR or less, with good speakers. High scores may indicate the need for directional microphones or assistive technologies.</td>
<td>Reflects the ability to follow speech in a noisy background. It can be affected by hearing loss and the ability to block out background noises (this ability decreases in normal healthy aging).</td>
</tr>
<tr>
<td>Rapid speech</td>
<td>In increase in score indicates an improvement. The average patient has about a 0.2 increase in score during training.</td>
<td>A score of 1.0× means the patient can only follow speech at normal conversational speeds. A score of 2.0× means that the patient can follow speech at 2 times the rate of conversational speeds.</td>
<td>Reflects the ability to follow fast speech with some of the speech information removed. It can be affected by hearing loss and by the effects of normal aging (slower processing speed).</td>
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<tr>
<td>Word memory</td>
<td>An increase in score indicates an improvement. The lowest score possible is a 1.0 and the highest score possible is a 6.0.</td>
<td>A low score (lower than 3) indicates either significant difficulty remembering spoken information or difficulty understanding speech in a quiet background.</td>
<td>Reflects the ability to understand and remember specific speech information (auditory memory). It can be affected by normal aging (working memory skills).</td>
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Table 2  continued from previous page

<table>
<thead>
<tr>
<th>Training task</th>
<th>Scoring trends to look for</th>
<th>Patient counseling notes</th>
<th>Other considerations</th>
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<tbody>
<tr>
<td>Competing speaker</td>
<td>A decrease in score indicates an improvement. The average patient has about a 4 dB improvement during training.</td>
<td>A normal hearing listener will have a score of about 1 dB SNR or less, with good speakers. High scores may indicate the need for directional microphones or assistive technologies.</td>
<td>Reflects the ability to block out a single speaker and focus on another. It can be affected by hearing loss and by the ability to block out unwanted signals.</td>
</tr>
<tr>
<td>Missing word</td>
<td>An increase in score indicates an improvement. This score factors both speed and answers correct.</td>
<td>This task is included to remind the patient that they do not need to hear every word to understand the message. Non-native speakers may have more difficulty with this task.</td>
<td>Reflects the ability to fill-in words that were missed. It is an easier training task for most patients.</td>
</tr>
</tbody>
</table>

Note. LACE = Listening and Auditory Communication Enhancement; SNR = Signal-to-noise ratio.
derson Sabes and Sweetow (2007). For example, subjects with greater hearing loss and older subjects were more likely to complete the training in fewer days. This does not necessarily imply that older subjects are more willing to participate in AR training programs. Some elderly patients can be intimidated by the training process, particularly when computers are involved. However, it may suggest that older (possibly retired) trainees may be more able and willing to devote extensive time to training. They also reported that subjects with poorer initial performance generally demonstrated greater improvement. These findings are in agreement with other assessments of AR (Kricos & Holmes, 1996; Walden, Erdman, Montgomery, Schwartz, & Prosek, 1981).

CONCLUSION

LACE does not require substantial time, resource, or efforts by audiologists. Patients, however, must be motivated and educated of the importance of AR and AT. It should not be considered an add-on, but instead an integral part of the overall communication enhancement process. Improving patient compliance is enhanced by utilizing the automated e-mail service, but nothing substitutes for personal calls from the professional. It is not mandatory to monitor patient performance data but it certainly augments counseling, and reminds patients that there is more to the communication enhancement process than simply purchasing hearing aids. One patient who recently completed LACE told this author that “Getting new hearing aids without being provided with additional AR, is kind of like renting a car in an unfamiliar city without being provided with a roadmap.”

Audiologists understand and are willing to spend considerable time counseling and conveying realistic expectations, because without this crucial effort, the probability of failure is increased. Radical changes in technology have immediate impact on a profession. Changes in practice or procedures must overcome the hurdle of inertia. As a profession, we must accept the reality that hearing aids alone are not going to solve the many communication problems facing patients and that we have an ethical obligation to do everything we can to provide comprehensive solutions.

DISCLOSURE

The author has a financial interest in NeuroTone, the company producing LACE for the University of California, San Francisco.

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