MODIFICATIONS IN HEARING AID SELECTION PROCEDURES*

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Introduction

My experience in hearing aid evaluations has been that usually the aided Speech Reception Thresholds and Speech Discrimination scores are very similar from aid to aid on a given patient. When I started performing Hearing Aid Evaluations several years ago, I used only speech in quiet. Then, trying to keep up with current trends, I began introducing noise into the test room. I tried wide-band noise, speech-spectrum noise, and even multitalker noise (cocktail party effect). Still, the monosyllabic word scores came out about the same for each aid. Having become disenchanted with monosyllabic words, I added sentences to the listening task of the patients; but these scores also failed to produce differences among instruments.

I thought further about the method I was using. It made sense to me to keep using the same materials (words and sentences) and to present the speech both in quiet and in noise. What did not make sense was that I was presenting the speech discrimination materials at one intensity level. My procedure was as follows: I would set the gain of each aid so that moderate-intensity speech (i.e., about 65 dB SPL or 45 dB Hearing Level) was comfortably loud to the patient. Then I would obtain the SRT and uncomfortable loudness level. These two measures would usually be approximately the same from aid to aid. Then I would present the words and sentences at 45 dB HL (Hearing Level) and get about the same scores for all aids. There was the main flaw. It was unrealistic to measure the patient's speech discrimination at one intensity level, when in real life he would be listening to speech at various levels. Another mistake I had made was that I did not carefully determine the signal-to-noise ratio.

* Paper delivered at Fourth Annual ARA Meeting. The paper has been abbreviated for presentation here.

Method

My modified technique involved assessing speech discrimination at various intensity levels, unaided and aided, in quiet and in noise. The monosyllabic words were half-lists of W-22 words (Campbell, 1965). These were presented by live-voice. The sentences were the CID Everyday Speech Sentences, rearranged into ten homogeneous lists of ten sentences each. Each list contains fifty key words which are scored for intelligibility. These were presented from a tape. The noise was wide-band, i.e., its spectrum was relatively flat from 200 - 6000 Hz. The gain of each aid was set so that speech at 46 dB HL was judged most comfortable by the patient.

It would be impossible to ascertain a complete articulation function with each hearing aid, so I arbitrarily chose two or three different levels for each patient. Selection of the signal-to-noise (S/N) ratios was difficult, as was the decision where to place the loudspeakers. I chose to have the loudspeakers 90 degrees apart, so that speech was presented at a 45 degree azimuth toward the person's aided ear, and noise at a 45 degree azimuth toward the unaided ear.

In this arrangement, normal-hearing people listened to words and sentences in a background of noise. The S/N ratios which resulted in a slight loss of intelligibility were obtained. Next, hard-of-hearing subjects were given the same tasks. They required, on the average, 10 dB more favorable S/N ratios than the normals. Even these ratios were too difficult for several hard-of-hearing people, so I added another 6 dB to the ratios to be used in the Hearing Aid Evaluations. The S/N values will vary, of course, from clinic to clinic, depending on many factors--primarily the calibration values of the speech and noise, and type of noise. The important point is that the S/N ratios must be determined by experimentation.

Case Reports

I use this procedure with most older children and adults. However, because of the theme of this meeting, I will discuss four clients who were at least 60 years old.

Case number 1 is a male office worker, age 60. He has a bilateral, symmetrical, sensorineural loss. Pure-tone thresholds are 15 dB (ISO) at 250 Hz and slope quite sharply to 80 dB at 8000 Hz. The high-frequency emphasis (HFE) aid produced the poorest scores. The other two aids, which had relatively flat frequency responses, yielded similar scores in all but two conditions, in which one aid was far superior to the other. The conditions were W-22 words at 30 dB HL in quiet and W-22 words at 56 dB HL in noise. The words presented at 40 dB HL in quiet or in noise failed to reveal any differences. Results of this case demonstrate that the method of presenting speech at different HL's made the decision of selecting an instrument an easy one, whereas a procedure in which only speech presented at 40 dB HL or MCL in quiet or in noise would have shown no differences between two aids.

Case number 2 is an 86 year-old woman who was wearing an ear-level instrument which was about 15 years old. Her daughter had insisted that she come to the Clinic to try to find an aid which would be of more benefit than her old one. The woman's own aid was in good working order. I selected an aid which I had found particularly successful with elderly people with fairly flat losses such as hers for the comparison tests. All the results on both instruments were very similar. Both aids helped her somewhat in quiet when speech was presented at 40-50 dB HL. However, above that hearing level, either in quiet or in noise, her unaided scores were better than her aided scores. The woman was delighted with the fact that the new aid did not benefit her any more than the old one. Besides, she was determined not to spend money on a new instrument.

Case number 3 is a 79 year-old woman whose main complaint was that she could not understand speech in backgrounds of noise. Her audiogram showed a fairly flat configuration of pure-tone thresholds, averaging about 40 dB in each ear. Her aided sound-field SRT was 30 dB. Results of the Hearing Aid Evaluation showed that when words and sentences were presented at 30 dB HL, both a flat-response and an HFE instrument helped her considerably. When speech was presented at 46 dB HL, her aided and unaided scores were essentially the same with either aid. When noise was added, her scores were poorer when wearing the aids than when not wearing them. Therefore I recommended that she should not purchase an instrument, since she reported no difficulty in quiet situations. Had I assessed her speech discrimination only in quiet at 40-50 dB HL, I might have concluded that since her aided scores were no worse than her unaided scores, she should purchase the aid. I have a hunch she would have been one of those older people who put the hearing aid in a drawer.

Case number 4 is a retired 73 year-old man. His pure-tone audiogram reveals a bilateral, gently-sloping loss from 35 dB at 250 Hz to 75 dB at 8000 Hz. One HFE and two fairly flat-response aids were tried. There were no great differences among aids in scores of W-22 words presented in quiet at MCL or below. There were also no differences among aids in sentence scores presented at two levels in quiet. However, there were significant differences in the scores of the three aids in the noise conditions. The best scores were obtained with one of the flat-response instruments. In this case, had noise not been used in the HAE, no differences between aids would have been found.

Conclusions

This method of hearing aid evaluation has proven to be successful in a higher percentage of cases than methods which I formerly used. The advantage of the method is that a variety of scores is obtained using each aid. Words and sentences are presented at different intensity levels, both in quiet and in noise. The disadvantage of the method is that it takes more time (about one-half hour per instrument). From my experience using this method, I have decided that I would rather thoroughly evaluate a person's performance with fewer aids than to try more instruments under only one or two conditions. When this method fails to yield differences in scores, and the scores are all low, the patient is re-scheduled and more aids are tried. If none of the instruments helps him significantly, he is counselled to this effect. Depending upon many factors, purchase or rental of an aid may or may not be recommended. When this method yields similar scores on the three aids, but the scores are all high, I feel more confident that I used to in recommending purchase of any of the instruments, because I know that each aid helps him equally in a variety of listening conditions.

In summary, the main value of this method is that a more complete picture of a patient's performance with each instrument is obtained, as compared to a method which either does not include use of noise or does not include different intensity levels of speech.

Reference

Campbell, R.A., "Discrimination Test Word Difficulty", Journal of Speech and Hearing Research, 8: 1: 13-22 (1965)