

Monaural Hearing Aid Effect: Case Presentations

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Abstract

A phenomenon associated with a monaural hearing aid fitting has previously been identified. In some individuals with bilateral sensorineural hearing loss (BSNHL), the speech-recognition score (SRS) of the unfitted ear deteriorates over time. Nine subjects with BSNHL who chose a monaural hearing aid fitting are chronicled from the time of their initial hearing fitting to the time where the SRS of the unfitted ear dropped below the lower limit of the 95 percent critical difference value. All nine of the subjects were fitted with binaural amplification at the time of the significant change in the SRS. Five of the subjects retained the binaural amplification arrangement while three of the subjects returned their second hearing aid after a "30 day trial," and one subject stopped wearing the second hearing aid 8 months after the binaural fitting. All the subjects who chose to utilize the binaural arrangement had their SRS return to within the 95 percent critical difference range as did two of the individuals who chose to retain the monaural arrangement.

Key Words: Auditory deprivation, binaural amplification, hearing aid effect, monaural amplification, sensorineural hearing loss, speech recognition score

Silman, Gelfand, and Silverman (1984) were the first to report a progressive speech recognition score (SRS) decrement in the unaided ear of individuals with bilateral sensorineural hearing loss (BSNHL). This initial report was a retrospective study of male veterans with BSNHL, which showed that in the monaurally aided subject sample 39 percent of the unfitted ears had significant change in the SRS while just 4 percent of the fitted ears demonstrated significant change in the SRS over 4 to 5 years. A similar result was not found in the binaurally aided subjects. Gelfand, Silman, and Ross (1987) confirmed the previous work of Silman et al with another retrospective analysis of binaurally and monaurally fitted male veterans with BSNHL. Thus, Silman et al (1984) and Gelfand et al (1987) were the first to document the decline in the SRS of unaided ears and to hypothesize that the reduced SRS may result from a type of latent auditory deprivation.

Following these initial reports (Silman et al, 1984; Gelfand et al, 1987), other investigations (Hood, 1984, 1990; Dieroff and Meibner, 1989; Stubblefield and Nye, 1989) have reported a monaural ear effect. Hood (1984, 1990) attributed the poorer SRSs in the involved ears of unilateral Meniere's disease subjects compared to the SRSs in the better ears of bilateral Meniere's disease subjects to an auditory deprivation effect. Stubblefield and Nye (1989) studied the clinical records of four different subject groups 3, 4, 5, and 6 years post hearing aid fitting. Included in their investigation was a comparable sample of subjects who chose to remain unaided. Analysis of these retrospective data demonstrated a significant decrement in the SRSs for the unaided ears; thus, providing support for the original observations of Silman and colleagues. Dieroff and Meibner (1989) documented a SRS reduction in the unfitted ear of subjects with mixed hearing loss, and attributed the effect to either auditory deprivation or a form of auditory inactivity.

An alternative to the auditory deprivation hypothesis is Gatehouse's (1989, 1992) "acclimatization" theory that the aided ear adapts to receiving speech cues at high sensation levels; thus, the ear performs better on the suprathreshold speech recognition measure as

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the test materials are presented within the ear's adapted listening range. In contrast, the unaided ear adapts to speech cues at low sensation levels; thus, the ear performs poorer on the suprathreshold speech recognition measure because the test's presentation level is above the ear's adapted listening range. Gatehouse (1992) suggests that "acclimatization" may take only 12 weeks to occur post monaural hearing aid fitting.

Whether the reduction in SRS in the unaided ear of some monaurally fitted individuals results from auditory deprivation (Silman et al, 1984; Gelfand et al, 1987) or "acclimatization" (Gatehouse, 1989, 1992), the effect may be reversible in selected subjects with the application of amplification to the affected ear. Silverman and Silman (1990), and Silman et al (1992) reported cases where the decline in the unaided ear's SRS was curtailed when a hearing aid was applied, and document complete SRS recovery in two of the three cases and partial SRS recovery in the third case. Specifically, Silverman and Silman (1990) describe a

retrospective study of two monaurally fitted males with BSNHL. One subject demonstrated a significant SRS change in his unfitted right ear 6.5 years after the monaural fitting of his left ear. As there were no retests between 4 and 6.5 years, the significant SRS decrement may have occurred earlier than 6.5 years after the original monaural fitting. No apparent recovery in auditory function was evident at 8 months after the binaural fitting; however, at 2.5 years post binaural fitting, the SRS in the right ear returned within 2 percent of the 95 percent critical difference lower limit of the original SRS. The second subject demonstrated significant SRS reduction in his unaided right ear 2 years following the initial monaural fitting of the left ear; however, no retesting was performed until 2 years post fitting. The retesting at 2 years post binaural fitting showed the right ear's SRS to have recovered to a value well above the 95 percent critical difference lower limit of the original SRS. As no data were available before the 2 year retest due to the retrospective nature of the study, a finer esti-

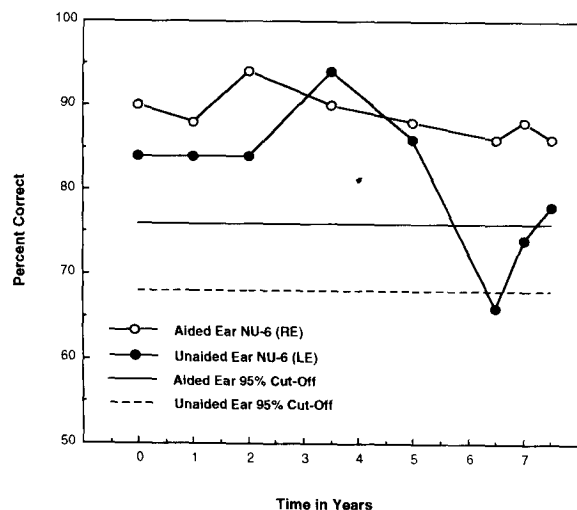
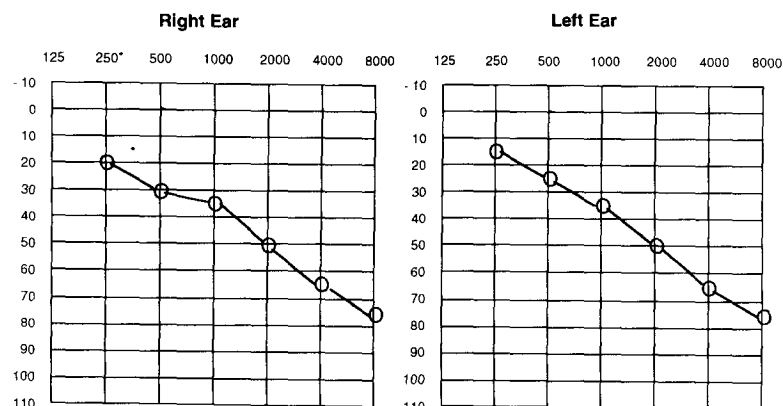


Figure 1 The composite audiogram and chronology of NU-6 scores for Subject 1, a 56-year-old female, over 7.5 years dating from the original right ear hearing aid fitting. The 95 percent cut-off value for each ear is based on the initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 6.5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, a hearing aid was fitted to the left ear with retesting at year 7 demonstrating a NU-6 score above the 95 percent cut-off value. After 1 year of a binaural hearing aid fitting, final retesting at 7.5 years continued to produce a left ear NU-6 score above the 95 percent cut-off.



mate of the time course of SRS recovery was not available. Subsequently, Silman et al (1992) used a single retrospective case study to illustrate their auditory deprivation hypothesis, and recovery from same in the unfitted left ear of a male subject with BSNHL. The SRS of the unfitted left ear decreased to a value below the lower limit of the 95 percent critical difference value 2 years after the initial monaural fitting of the right ear. After the binaural fitting, the left ear's SRS was elevated above the lower limit of the 95 percent critical difference 2 years after the binaural fitting. Again, due to the retrospective nature of the investigation, a finer estimate of the onset of the monaural hearing aid effect and the time course of the SRS recovery was not possible.

In summary, it appears that the unfitted ear SRSs of some monaurally fitted individuals with BSNHL decrease over time while the SRSs for the majority of binaurally fitted ears do not demonstrate a similar deterioration within the same time span. While these data generate multiple questions for investigation, one of the

most intriguing issues deals with the reversal of this monaural hearing aid effect with the application of amplification to the involved ear. The purpose of this report is to describe nine monaurally fitted subjects with BSNHL in which amplification was used in an attempt to reverse decreased auditory function in the originally unfitted ear. These nine individuals were culled from a larger subject sample of hearing aid wearers with BSNHL who were studied prospectively (Hurley, 1991). Further, the prospective nature of the parent investigation allowed regular monitoring of the fitted and the unfitted ears' auditory performances as reflected in the SRSs.

METHOD

Subjects

The subjects were two females and seven males who ranged in age from 56 to 63 years of age at the time of their initial evaluation. Each subject was examined on a regular basis for re-

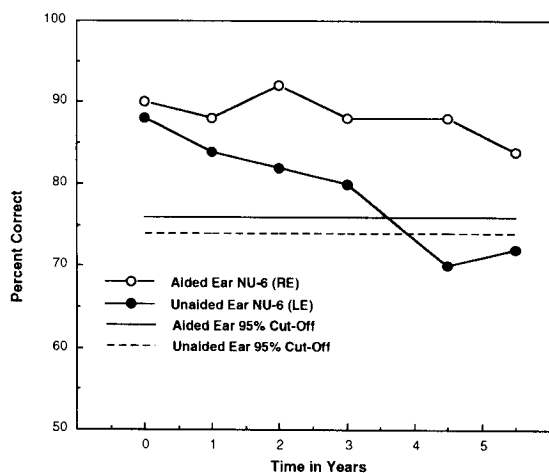
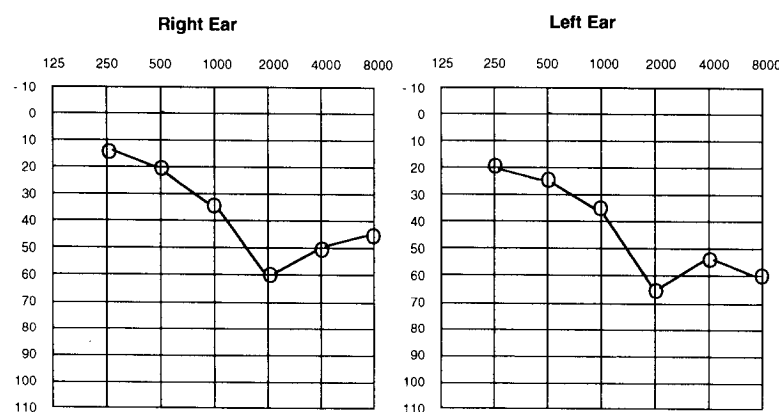


Figure 2 The composite audiogram and chronology of NU-6 scores for Subject 2, a 58-year-old male, over 6.5 years dating from the original right ear hearing aid fitting. The 95 percent cut-off value for each ear is based on the initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 4.5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, a hearing aid was fitted to the left ear. However, Subject 2 returned the left ear hearing aid without retesting after a "30 day trial" with the binaural hearing aid arrangement. Final retesting at 5.5 years demonstrated a left ear NU-6 score below the 95 percent cut-off value.



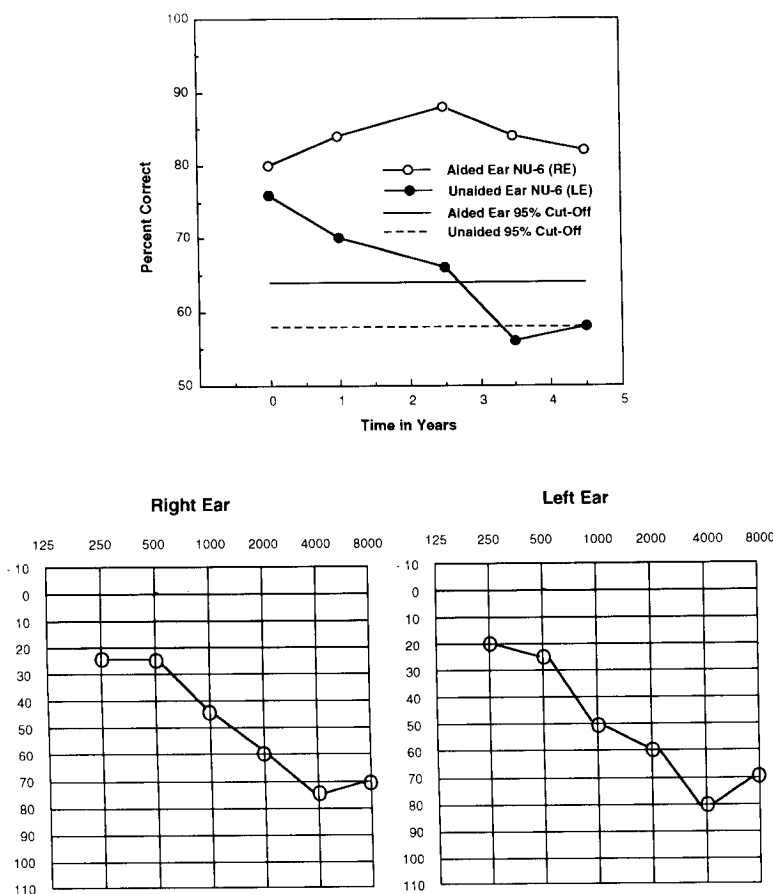


Figure 3 The composite audiogram and chronology of NU-6 scores for Subject 3, a 60-year-old male, over 4.5 years dating from the original right ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 scores. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 3.5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid. However, Subject 3 returned the left ear hearing aid without retesting after a "30 day trial" with the binaural hearing aid arrangement. Final retesting at 5.5 years demonstrated a left ear NU-6 score equal to the 95 percent cut-off value.

evaluation of hearing status and hearing aid arrangement. At the initial evaluation, each subject demonstrated the following: (1) an average hearing level (HL) of 30 dB or greater for the octave frequencies of 500 to 2000 Hz; (2) a normal tympanogram and contralateral acoustic reflex thresholds within the 95 percent cut-off limits for the octave frequencies of 500 to 2000 Hz (Silman and Gelfand, 1981); (3) no interaural frequency difference greater than 10 dB at two adjoining frequencies for the octave frequencies of 500 to 4000 Hz; and (4) no interaural difference greater than 6 percent for 50 presentations per ear of recorded NU-6 materials. In addition, each subject had an otologic examination prior to the hearing aid fitting, and at the time of the significant change in the SRS. None of the subjects demonstrated any indication of retrocochlear dysfunction. By their own choice, all nine subjects were monaurally fitted with a linear in-the-ear type hearing aid. As the initial SRSs were essentially symmetrical, the ear choice for the monaural fitting was determined by each subject based on personal preference. Each subject claimed hearing aid usage of at least 8 hours per day. All subsequent evaluations consisted of the following: (1) pure-tone

audiometry; (2) immittance measures; and (3) 50 words per ear of recorded NU-6 materials presented at 40 dB SL re: the SRT (Wilson et al, 1973). In each of the nine cases, the monaural hearing aid fitting occurred within 28 days of the initial evaluation. Likewise, the second hearing aid was fitted within 28 days of the date when the unfitted ear's SRS dropped below the 95 percent critical difference cut-off value (Thornton and Raffin, 1978).

RESULTS

The upper segments of Figures 1 through 9 display the NU-6 scores of each subject's aided ear and unaided ear from the initial NU-6 score to the time when the unaided ear's NU-6 score fell below the 95 percent critical difference criteria to the time of the final retesting. Thus, each figure is a time series of auditory performance using the NU-6 as the SRS parameter. In addition, the lower segment of each figure displays a representation of the hearing levels (HL) exhibited by each subject for the time span of the study. Each subject's HL fluctuation over time for the octave frequencies of 250 to 4000 Hz did not exceed ± 5 dB of the initial

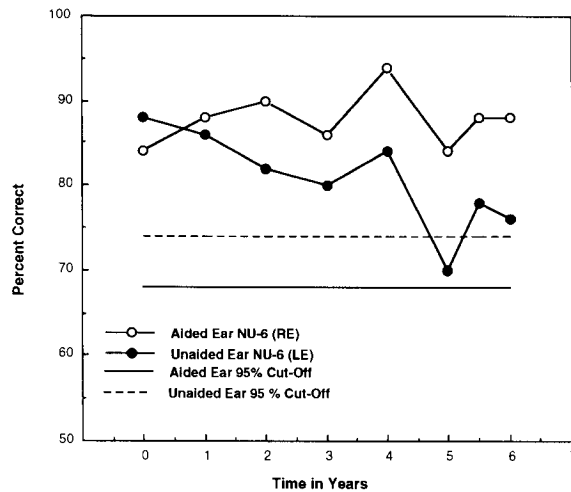
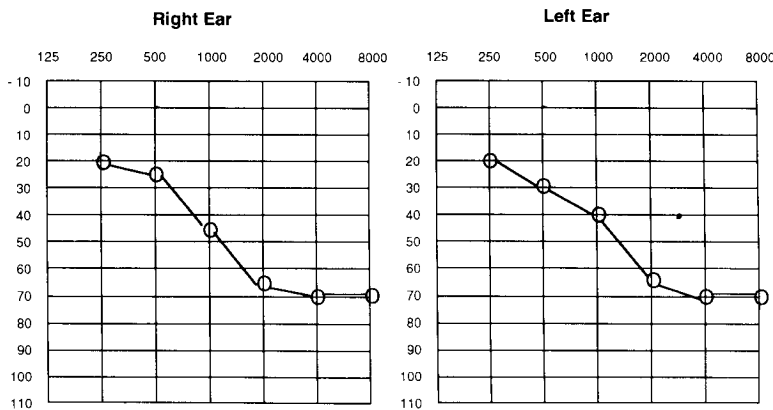


Figure 4 The composite audiogram and chronology of NU-6 scores for Subject 4, a 59-year-old male, over 6.0 years dating from the original right ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid with retesting at 5.5 years demonstrating a NU-6 score above the 95 percent cut-off value. After 1 year of a binaural hearing aid fitting, final retesting at 6 years demonstrated a left ear NU-6 score above the 95 percent cut-off value.



HL except at 8000 Hz where some subjects demonstrated a 5 to 10 dB increase in hearing loss over the time span.

On the average, these nine subjects exhibit moderate BSNHL with a mean of 45.2 dB and a range of 36.3 to 55.0 dB in the aided ear, and a mean of 45.8 dB and a range of 35.0 to 53.8 dB in the unaided ear for the octave frequencies of 500 to 4000 Hz, and good to excellent bilateral SRSs. Whereas the pure-tone configurations appear to be varied with no consistent pattern emerging, some degree of grouping is possible as Subjects 1, 6, and 7 exhibited a gradual and continuous sloping configuration between 500 and 8000 Hz in contrast to Subjects 2, 5, and 9 who exhibited a sloping configuration with a notch at 2000 Hz, and Subject 8 who demonstrated a rapidly falling configuration above 500 Hz and a notch at 4000 Hz. Eight of the subjects chose the right ear for the monaural fitting with one subject, Subject 7, selecting the left ear for fitting.

As illustrated in the Figures, the initial SRSs ranged from 80 percent to 100 percent with a mean of 89.7 percent for the aided ears, and ranged from 76 percent to 100 percent with a mean of 87.3 percent for the unaided ears. Coincidentally, the subject-selected ear for fitting had the higher SRS in seven of the nine cases, the same SRSs in one case, and poorer SRS in one case. At the time when the unaided ear SRS fell below the 95 percent critical difference value, the aided ear SRSs ranged from 80 percent to 100 percent with a mean of 88.9 percent while the unaided ear SRSs ranging from 58 percent to 80 percent with a mean of 70.0 percent. The final SRSs for aided ear ranged from 82 percent to 100 percent with a mean of 88.9 percent while the originally unaided ear SRSs ranged from 58 percent to 86 percent with a mean of 75.6 percent. Another way to view these data is to consider the interaural SRS differences, which initially ranged from 0 to 6 percent and ranged from 12 percent to 28 per-

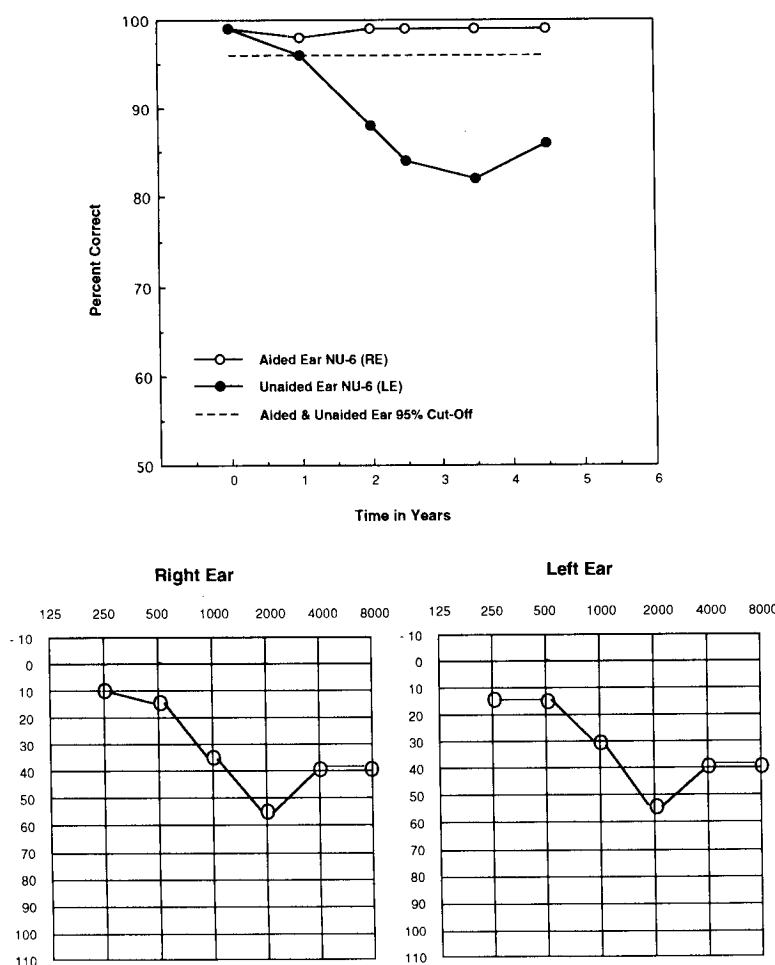


Figure 5 The composite audiogram and chronology of NU-6 scores for Subject 5, a 53-year-old female, over 4.5 years dating from the original right ear hearing aid fitting. The 95 percent cut-off value is based on each ear's initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. (The right ear NU-6 scores depicted at the 99 percent level were actually at the 100 percent level, but were reduced to the 99 percent value for graphic clarity). At 2 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid with retesting at 2.5 years demonstrating a NU-6 score below the 95 percent cut-off value. After 8 months of binaural amplification, Subject 5 stopped wearing the left ear hearing aid. Retesting at 3.5 and 4.5 years revealed left ear NU-6 scores below the 95 percent cut-off value.

cent when the unaided ear's SRS exceeded the lower limit of the 95 percent critical difference value. The final interaural NU-6 differences ranged from 8 percent to 20 percent which reflects the fact that none of the nine subjects had the SRS of the involved ear return to a value equal to or greater than the original SRS.

The change in the unaided ear SRSs of Subjects 1 and 4, depicted in Figures 1 and 4, reflects an abrupt pattern of decline in contrast to the progressive pattern of decline reflected in the unaided ear SRS time sequence exhibited by the other seven subjects as depicted in Figures 2 and 3, and Figures 5 through 9. Conversely, Subjects 1 and 4 exhibited a rapid recovery in their unaided ear SRSs after the binaural fitting. Subjects 2, 3, and 6 returned their hearing aids after a "30 day trial" with a binaural fitting; and Subject 5 stopped using the second hearing aid 8 months after the binaural fitting. Further, Subjects 1, 4, 7, 8, and 9, who continued to wear binaural amplification, had their originally unaided ear SRSs return to within the 95 per-

cent critical difference of the initial NU-6 score as was the case for Subjects 3 and 6 who rejected the binaural fitting. The unaided ear SRSs for Subjects 3 and 6 returned to values within the 95 percent critical difference range 12 months after rejecting the binaural fitting, but the SRSs were still 18 percent and 10 percent, respectively, below the original SRSs as opposed to Subjects 1, 4, 7, and 9 who had their best unaided ear SRSs after the binaural fitting return to within 6 percent to 10 percent of the original SRS.

DISCUSSION

These nine subjects illustrate the clinical reality of a monaural hearing aid effect, which occurs in the unfitted ear of some individuals with BSNHL. This monaural hearing aid effect is manifested as a decrement in the unfitted ear's SRS and is considered to be significant when the SRS falls below the lower limit of 95 percent critical difference value

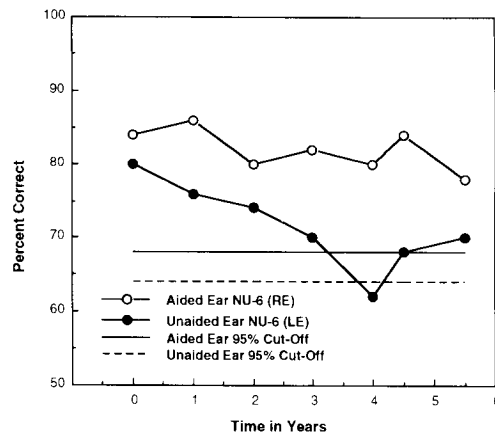
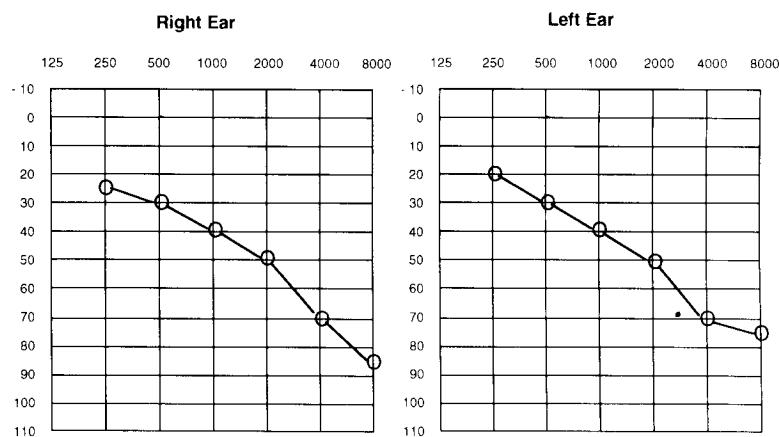


Figure 6 The composite audio-gram and chronology of NU-6 scores for Subject 6, a 56-year-old male, over 5.5 years dating from the original right ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 4 years, the left ear NU-6 scores fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid. However, Subject 6 returned the left ear hearing aid without retesting after a "30 day trial" with the binaural hearing aid arrangement. Retesting at 4.5 and 5.5 years showed a return of left ear NU-6 performance to values above the 95 percent cut-off value.



(Thornton and Raffin, 1978) which is based on the SRS at the time of the original monaural hearing aid fitting. The unfitted ear effect exhibited by these nine subjects is consistent with previous reports of the phenomenon (Silman et al, 1984; Gelfand et al, 1987; Silverman, 1989; Stubblefield and Nye, 1989; Silverman and Silman, 1990; Silman et al, 1992). Silverman and Silman (1990) and Silman et al, (1992) have indicated that this unfitted ear effect can occur as soon as 2 years after the original monaural hearing aid fitting with the average time span being 4 years for the significant SRS change to occur (Silman et al, 1984; Gelfand et al, 1987). Interestingly, Gatehouse (1992) demonstrated a decrease in the auditory function of the unfitted ear as soon as 3 months after the monaural fitting using speech-in-noise materials. The present results, based on NU-6 performance in quiet, suggest the monaural hearing aid effect in individuals with BSNHL can occur as soon as 1 year post monaural hearing aid fitting, and may occur as long as 5 years after the original

monaural fitting. In short, the onset of the unfitted ear effect appears to be variable and, perhaps, could be detected sooner if a more sensitive test paradigm were utilized.

Silverman and Silman (1990), and Silman et al (1992) have reported that the significant decrement in SRS performance of the unfitted ear can be reversed by a binaural fitting. Five of the present subjects demonstrate a reversal of the unfitted ear effect within 6 months following a binaural fitting. However, restoration of auditory function, as reflected in a positive change in the SRS, through a binaural fitting may not be successful in every case as exemplified by the four subjects who rejected the binaural arrangement. Unfortunately, three of the four subjects who rejected the binaural fitting used binaural amplification for only a "30 day trial" leaving unanswered their potential for recovery from the monaural hearing aid effect since Silverman and Silman (1990) and Silman et al (1992) have indicated that auditory recovery may take as long as 2 to 3 years after the

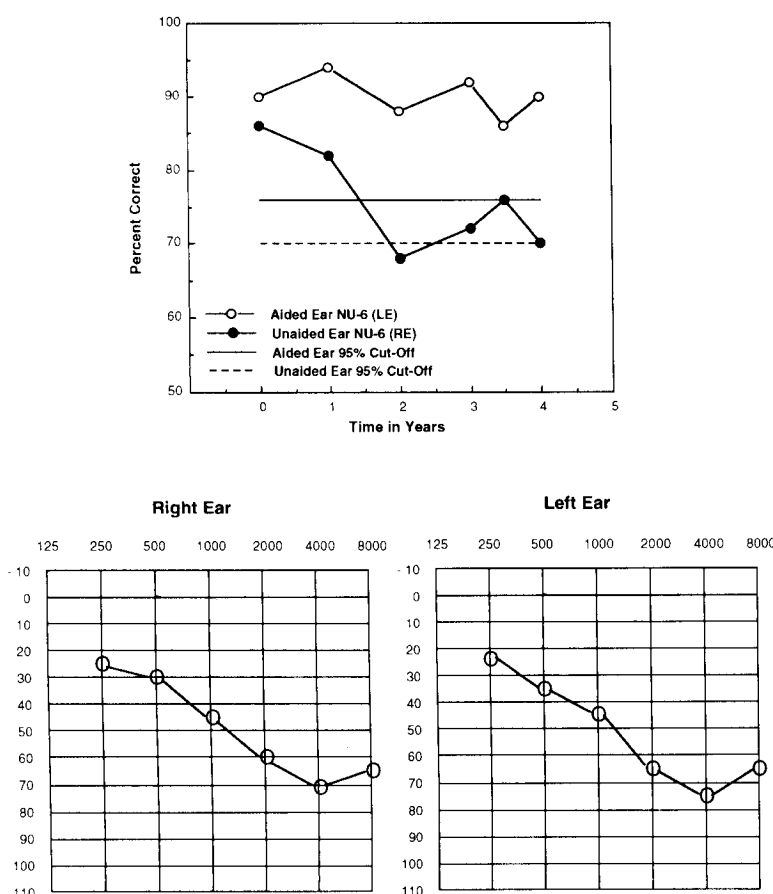


Figure 7 The composite audiogram and chronology of NU-6 scores for Subject 7, a 56-year-old male, over 4 years dating from the original left ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 score. The left ear NU-6 performance never falls below the 95 percent cut-off value over the time series. At 2 years, the right ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the right ear was fitted with a hearing aid with retesting at 3 years showing a NU-6 score above the 95 percent cut-off value. Further retesting at 3.5 and 4.0 years produced right ear NU-6 scores at or above the 95 percent cut-off value.

fitting of binaural amplification. Perhaps, the three subjects, Subjects 2, 3, and 6, who returned their hearing aids after a trial period may have demonstrated a larger change in their SRS performance with a binaural hearing aid arrangement if they had worn the binaural arrangement on a daily basis for a reasonable period of time, i.e., 6 to 12 months.

Speculatively, factors such as financial or hearing loss/hearing aid acceptance may have influenced the subject's decision to return the second hearing aid. Given that neither a moderate hearing loss nor a hearing aid are easily acceptable by most people, the three subjects who returned their second hearing aid at the end of the "30 day trial" were sufficiently concerned about their hearing health care to seek professional evaluation and consultation, to use amplification without delay, and to return for regular retesting. In fact, Subject 5 was sufficiently self-motivated to wear the binaural fitting for 8 months before returning to the monaural arrangement. In addition, all nine subjects readily accepted and acted on the recommendation for a binaural fitting in a timely fashion. Arguably, these behaviors could be used as an indication that hearing loss/hearing

aid acceptance was not a factor in rejecting the binaural fitting. Further, each of the three subjects who rejected the binaural arrangement after the trial period indicated that a monetary factor was not involved in the returning of the second hearing aid. Annotated comments from Subject 5 as well as from Subjects 2, 3, and 6 indicated that the binaural fitting was less effective in meeting their communications needs than the monaural fitting. Thus, remediation through binaural amplification was successful in five of the nine subjects if the criteria for success is a return of the SRS to a value above the lower limit of the 95 percent critical difference based on the original SRS.

Although these nine subjects may represent a small segment of individuals with BSNHL, they illustrate the unfitted ear effect, and suggest that application of binaural amplification to reverse the effect will not always be successful. Experience with these nine subjects indicates that the unfitted ear effect may be reversed after 6 months of binaural amplification as each of the five subjects who retained the binaural hearing aid arrangement demonstrated a significant SRS increase 6 months after the binaural fitting. Unfortunately, retesting was

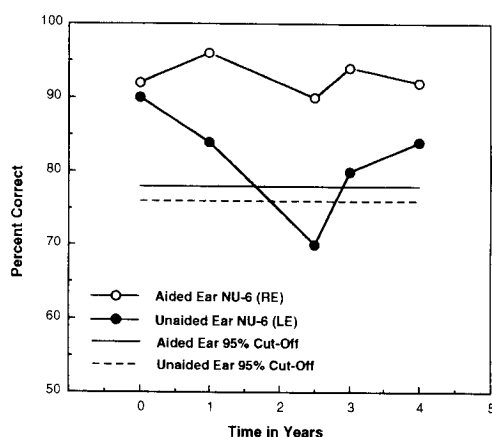
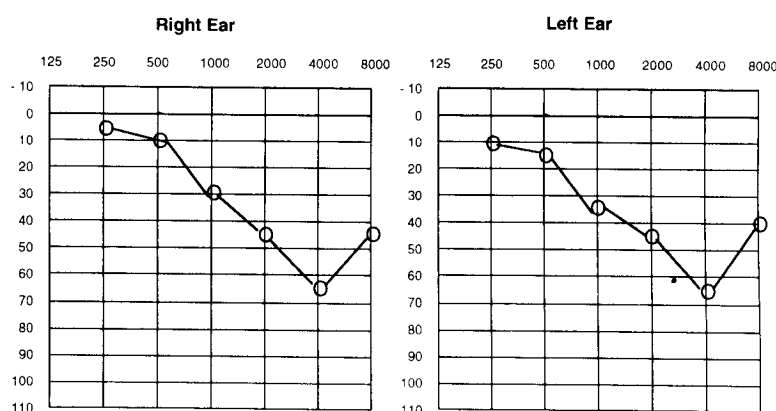


Figure 8 The composite audiogram and chronology of NU-6 scores for Subject 8, a 58-year-old male, over 4 years dating from the original right ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 score. (The right ear NU-6 scores depicted at the 99 percent level were actually at the 100 percent level, but were reduced to the 99 percent value for graphic clarity). The right ear NU-6 performance never falls below the 95 percent cut-off value throughout the time series. At 2.5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid with retesting at 3 years producing a NU-6 score above the 95 percent cut-off value. Final retesting after 18 months with the binaural hearing aid arrangement continued to demonstrate a left ear NU-6 score above the 95 percent cut-off value.



not done at the time the three subjects returned their second hearing aid after a "30 day trial," but the annotated comments of the subjects who rejected the binaural fitting suggests that the success or failure of a binaural fitting in reversing the monaural fitting effect may be determinable at the end of a "30 day trial" period.

The results provided by these nine subjects justifies the need for periodic testing of all individuals with BSNHL who receive monaural hearing aid fittings, and demonstrates that the "unfitted ear effect" may not be reversible in all individuals with the initiation of a binaural hearing aid fitting. Further, experience with these subjects indirectly questions the tenet that a binaural hearing aid fitting is the preferred hearing aid arrangement for all individuals with BSNHL. Four of the nine subjects rejected the binaural fitting in favor of the monaural arrangement possibly because of a strong innate ear dominance effect not reflected in the SRS. Left unanswered, however, is the question of whether or not an initial binaural fitting may have averted the onset of the unfitted ear effect. Clearly, these nine subjects dem-

onstrate the need for continued research into the various aspects of this unfitted ear effect such as the underlying pathophysiology, i.e., is this effect the result of an auditory deprivation mechanism, "acclimatization," or an as yet unidentified factor(s). In addition, the clinical profile of an "at risk" individual with BSNHL needs to be defined, as do the factors to predict successful reversal of the unfitted ear effect through binaural amplification.

Acknowledgment. The author gratefully acknowledges the three anonymous reviewers and Shlomo Silman for their valuable comments.

This manuscript is partially based on a poster presentation at the Annual Convention of the American Academy of Audiology, Denver, Colorado, April, 1991.

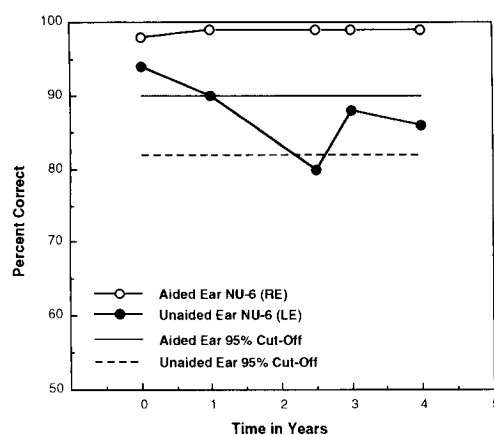
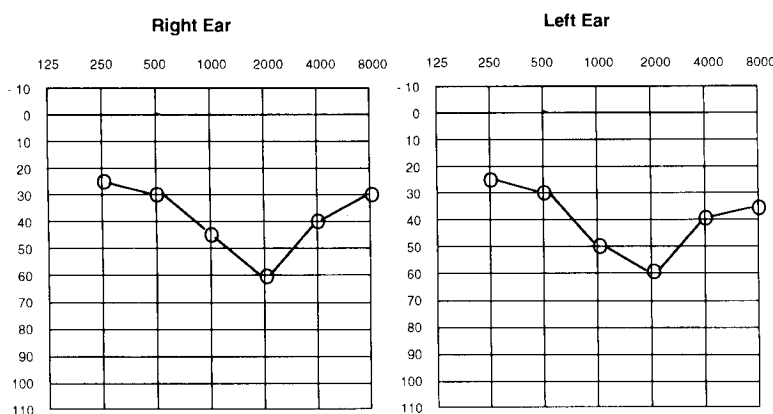


Figure 9 The composite audiogram and chronology of NU-6 scores for Subject 9, a 50-year-old female, over 4 years dating from the original right ear hearing aid fitting. The 95 percent cut-off values are based on each ear's initial NU-6 score. The right ear NU-6 performance never falls below the 95 percent cut-off value over the time series. (The right ear NU-6 scores depicted at the 99 percent level were actually at the 100 percent level, but were reduced to the 99 percent value for graphic clarity). At 2.5 years, the left ear NU-6 score fell below the 95 percent cut-off value. Subsequently, the left ear was fitted with a hearing aid with retesting at 3 years indicating a NU-6 score above the 95 percent cut-off value. Final retesting after 18 months with the binaural hearing aid arrangement showed continued left ear NU-6 score above the 95 percent cut-off value.



REFERENCES

- Dieroff HG, Meibner S. (1989). Zum Problem von Inaktivitätserscheinungen bei einseitiger Hörgeräteversorgung hochgradig Schwerhöriger. *HNO* 37: 472-476.
- Gatehouse S. (1989). Apparent auditory deprivation effects of late onset: the role of presentation level. *J Acoust Soc Am* 88:2103-2106.
- Gatehouse S. (1992). The time-course and magnitude of perceptual acclimatization to frequency responses: evidence from monaural fitting of hearing aids. *J Acoust Soc Am* 92:1258-1268.
- Gelfand SA, Silman S, Ross L. (1987). Long-term effects of monaural, binaural and no amplification in subjects with bilateral hearing loss. *Scand Audiol* 16:201-207.
- Hood JD. (1990). Problems in central binaural integration in hearing loss cases. *Hear Instr* 41(4):6, 8, 11, 56.
- Hood JD. (1984). Speech discrimination in bilateral and unilateral hearing loss due to Meniere's disease. *Br J Audiol* 18:173-177.
- Hurley RM. (1991). *Hearing Aid Use and Auditory Deprivation: A Prospective Study*. Poster presented at the Annual Convention of the American Academy of Audiology, Denver, CO.
- Silman S, Gelfand SA. (1981). The relationship between magnitude of hearing loss and acoustic reflex threshold levels. *J Speech Hear Disord* 46:312-316.
- Silman S, Gelfand SA, Silverman CA. (1984). Effects of monaural versus binaural hearing aids. *J Acoust Soc Am* 76:1357-1362.
- Silman S, Silverman CA, Emmer MB, Gelfand SA. (1992). Adult-onset auditory deprivation. *J Am Acad Audiol* 3:390-396.
- Silverman CA (1989). Auditory deprivation. *Hear Instr* 40(9):26-32.
- Silverman CA, Silman S. (1990). Apparent auditory deprivation from monaural amplification and recovery with binaural amplification. *J Am Acad Audiol* 1:175-180.
- Stubblefield J, Nye C. (1989). Aided and unaided time-related differences in word discrimination. *Hear Instr* 40(9):38-43, 78.
- Thornton AR, Raffin MJ. (1978). Speech discrimination scores modeled as a binomial variable. *J Speech Hear Res* 21:507-518.
- Wilson RH, Morgan DE, Dirks DD. (1973). A proposed SRT procedure and its statistical precedent. *J Speech Hear Disord* 38:184-191.

EDITORIAL COMMENT

In this paper, Hurley shows us nine cases in which speech recognition scores for both the aided and unaided ears of persons with bilateral sensorineural loss were measured systematically over periods ranging from 4.5 to 7.5 years after initial monaural amplification. In each case the "unaided ear effect" was striking and unmistakable. In each case, moreover, the originally unaided ear was ultimately aided. Results mirrored the original Silverman and Silman observation. After binaural fitting there was at least some recovery of speech recognition ability on the originally unaided ear. A further complication arose, however. In six of the nine cases, the binaural fitting was successful, but three of the nine patients rejected the binaural arrangement and opted for the original monaural configuration. After a brief trial period, these three individuals indicated that one hearing aid was preferred over two. Such a result is not inconsistent with the "binaural interference" phenomenon described by Jerger et al in the March, 1993 issue of this *Journal*.

These various observations seem to be converging on the following hypotheses concerning presbycusis hearing loss.

1. At the very first sign of bilateral hearing loss it is critical to fit binaural amplification. The longer that loss in either ear is ignored, the more deterioration there will be in speech processing ability.
2. If only one ear is aided there will be an asymmetric decline in speech processing ability (the "unaided ear effect").
3. The unaided ear effect may be reversible if amplification is instituted in a timely fashion.
4. Eventually there will come a time when the asymmetry in speech processing ability due to the unaided ear effect cannot be reversed. At that point, the binaural interference phenomenon may appear.
5. When binaural interference is present, binaural amplification may no longer be feasible.

These working hypotheses may suggest a framework within which both further research on the unaided ear effect and revised clinical intervention strategies may be contemplated.

REFERENCE

- Jerger J, Silman S, Lew HL, Chmiel R. (1993). Case studies in binaural interference: converging evidence from behavioral and electrophysiologic measures. *J Am Acad Audiol* 4:122-131.