Quality of life and speech perception in two late deafened adults with cochlear implants

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Abstract

The aim was to demonstrate the need for a quality of life assessment in biopsychosocial aural rehabilitation (AR) practices with late deafened adults (LDAs) with cochlear implants (CIs).

We present a case report of a medical records review of two LDAs enrolled in a biopsychosocial group AR program. A speech perception test *Contrasts for Auditory and Speech Training* (CAST) and a quality of life (QoL) assessment the *Nijmegen Cochlear Implant Questionnaire* (NCIQ) were given prior to AR therapy. CAST scores indicated both patients had excellent basic speech perception. However, NCIQ results revealed patients' difficulties in basic and advanced listening settings. NCIQ highlighted patients' self-perceived poor self-esteem and ongoing challenges to their QoL. Speech perception testing results alone are not enough to document the daily challenges of QoL needs of LDAs with CIs. The inclusion of a QoL measure such as the NCIQ is vital in evaluating outcomes of cochlear implantation in LDAs.

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Introduction

Severe to profound hearing loss (HL) is well recognized as having adverse psychosocial effects on the quality of life (QoL) of patients and their significant others.[1,2] Such effects can be more devastating for late deafened adults (LDAs) especially if they lose their hearing suddenly. Increasingly, patients with severe to profound sensori-neural hearing loss are receiving cochlear implants (CIs).[3] The current clinical standard of care for LDAs with CIs relies primarily on results of speech perception tests to assess a patient's listening performance skills.[4] However, these tests are not designed to reflect patients' subjective perceptions of their hearing loss nor QoL. With the recent shift in health care treatment from a medical to a biopsychosocial model, speech perception testing alone cannot provide qualitative information within a holistic framework for aural rehabilitation (AR).[5-8] Several researchers, Bodmer *et al*.[5] and Klop *et al*.[9] reported that the duration of hearing deprivation experienced by LDAs with CIs is a strong predictor of how well they will perform on speech perception tests. This case report presents a description of two LDA females with CIs with variable duration of hearing deprivation and their overall performance with their implants as assessed using a traditional speech perception test *Contrasts for Auditory and Speech Training* (CAST) and a QoL measure, the *Nijmegen Cochlear Implant Questionnaire (NCIQ*) as part of a group aural rehabilitation program.

Case Report

Subjects

This medical records review case report was approved by the University of North Carolina at Greensboro (UNCG) IRB and allowed for information to be extracted from patients' files at the UNCG Speech and Hearing Center. This information included demographic information and results of speech perception testing and QoL assessment for each patient. Both patients were females who experienced sudden hearing loss in their fifties. The first patient (Patient A) was a woman who suddenly (over one weekend) lost her hearing bilaterally due to autoimmune disorder. She had to wait five years before being implanted due to strict candidacy criteria at the time of her hearing loss and the cost of implantation. The second patient (Patient B) was a woman who lost her hearing bilaterally due to bacterial meningitis. She was implanted one month after hospitalization and treatment with IV antibiotics. Both patients were unilaterally implanted and functioned bimodally using a CI on one ear and a hearing aid on the other/better ear. Patients were referred to the UNCG Speech and Hearing Center as

poor performers by their local ENT physicians and audiologists. Subsequently, the two patients were enrolled in UNCG Cochlear Implant Connections (CIC), a weekly biopsychosocial AR group program. Patients were tested for speech perception skills and were assessed on their QoL prior to their beginning their participation in group and individual therapy.

Speech perception testing and quality of life assessment

Contrasts for Auditory and Speech Training

Patients were given the CAST,[7] a speech perception test that is divided into seven sub-level assessments. For this case report, each patient's scores for levels one through five were used to assess speech perception in quiet prior to designing patients' individual auditory perceptual treatment plans. CAST levels included for this case report were: Level 1-Recognition of Suprasegmental Features; Level 2-Recognition of Phonemically Dissimilar Words; Level 3-Recognition of Vowels Wide Vowel Contrasts and Narrow Vowel Contrasts; Level 4-Recognition of a Consonants Manner Features; and Level 5-Recognition of Consonant Voicing Features. A total score for each patient was also calculated.

Nijmegen cochlear implant questionnaire

Each patient completed the NCIQ to assess her quality of life using a cochlear implant and hearing aid.[8] The NCIQ consists of 60 questions in three domains divided into six subdomains: *Sound perception basic, Sound perception advanced, Speech production, Psychological functioning/self-esteem, and Social functioning (Activity and social interaction)*. For this case report, subdomain 3 (*Speech production*) results are not presented. Each patient's response to 50 survey questions over the five remaining subdomains were analyzed. Each NCIQ subdomain included 10 items: 49 items were formulated on a 5-point response scale. The 5 response categories were: never (1), sometimes (2), often (3), mostly (4), and always (5). The 50th item queried the CI user's perception of holding a simple telephone conversation and was scored on 5-item scale: no (1), poor (2), fair (3), good (4), and quite well (5). Patients were given the option of selecting a sixth response category of N/A to note survey items they deemed not relevant to their individual situations. The NCIQ subdomain mean score for each patient was derived by assigning values to survey items as follows: 1 = 0, 2 = 25, 3 = 50, 4 = 75, and 5 = 100. The mean score for each subdomain was calculated for each patient. *N/A* or blank responses were not included.

Table 1 presents four selected responses in each of the five categories of the NCIQ for each patient. Four items from each subdomain were selected to qualitatively highlight similarities and dif-

Table 1. Patients' responses to selected questions in five NCIQ subdomains.

NCIQ question number	Question	Never 1	Sometimes 2	Regularly 3	Usually 4	Always 5	NA 6
Sound perception basic							
(13)	Can hear doorbell/telephone ring		A		B		
(25)	Able to hear cars approaching in traffic		A		B		
(31)	Can hear soft noises as microwave beeping		A		B		
(37)	Can hear someone approaching from behind		A		B		
Speech perception advanced							
(11)	Quiet conversation (2 persons or more with/without lipreading)	A			B		
(17)	Understand shop assistant in a busy shop		A and B				
(23)	Enjoy music		A and B				
(60)	Able to hold a simple telephone conversation	A				B	
Psychological functioning/self-esteem							
(4)	Feel at ease in company		A		B		
(10)	Bothered about being hard of hearing		B	A			
(16)	Irritated if can not follow conversations		B	A			
(54)	Being HI undermines self confidence			A		B	
Activity limitation							
(24)	Hearing impairment as serious problem in functioning at home	B	A				
(36)	Hearing impairment as serious problem when watching TV		B			A	
(46)	Hearing impairment as serious problem in formal matters as insurance		B			A	
(51)	Hearing impairment as serious problem when going out		B	A			
Social interaction							
(2)	Hearing impairment as obstacle when dealing with persons with normal hearing		B			A	
(14)	Hearing impairment as serious problem when dealing with a group of persons			B		A	
(26)	Feel left aside in company because of the hearing impairment		B	A			
(38) and (43)	HI as an obstacle in dealing with neighbors and family members		B	A			

Patient A is an African-American female who lost her hearing suddenly due to Meningitis. Her CAST total score was 98%; Patient B is a Caucasian female who lost her hearing suddenly due to an Autoimmune Disorder. Her CAST total score was 97%.

ferences between patient responses. Item selection for Table 1 was based upon the authors' AR experiences with LDA patients. NCIQ question numbers reported by subdomains were *Basic speech perception* (13,25,31,37), *Advanced speech perception* (11,17,23,60), *Psychological functioning/self-esteem* (4,10,16,54), *Activity [limitation]* (24,36,46,51), and *Social interaction* (2,14,26, 38,43).

Discussion

Contrasts for Auditory and Speech Training

Figure 1 displays CAST five levels and total mean pre-test percentage scores for the two patients. Both patients scored very high on all five levels of the CAST (90% and above). Individual level scores ranged from 90 to 100 percent, indicating both patients had excellent speech perception in quiet listening conditions. Both patients demonstrated more difficulty (lower scores) on level 5 (*Recognition of consonant voicing features*) such as perceiving the differences between two words, such as *tip/dip* and *Jerry/cherry*. Patient B (who received her implant immediately after losing her hearing due to meningitis) performed better in Level 4 (*Recognition of consonant manner features*, such as *mop/chop* and *ship/chip*. However, overall CAST mean percentage scores indicated both patients performed well (above 95% accuracy) with their CIs in a quiet therapy room environment.

Nijmegen Cochlear Implant Questionnaire

Basic and advanced sound perception

For the *Basic* and *Advanced sound perception* subdomains of the NCIQ, a low score indicated more difficulty with sound perception. Both patients reported experiencing difficulties across the two listening subdomains (*Basic* and *Advanced sound perception*) with mean scores ranging between 22-60% (Figure 2). Patient B (immediately implanted) reported less difficulty in basic and advanced sound perception and less negative impact on her social and psychological functioning than Patient A (delayed implantation). As seen in Table 1, NCIQ responses showed that Patient A and B differed in their perceptions of their ability to hear and understand basic environmental sounds, such as a doorbell ringing, telephone ringing, or someone approaching from behind. Patient A demonstrated more difficulty in basic sound perception skills than did Patient B. In the area of advanced sound perception, which highlighted questions regarding speech perception and listening to music, this difference between patients was also demonstrated in the ability to listen to conversation in a quiet environment and over the telephone. Again, Patient A perceived more difficulty than Patient B in understanding in these listening conditions. Both patients reported difficulty in listening to music and in understanding speech in a noisy public environment, such as in a business/shopping setting.

Figure 2 displays patients' quantitative mean scores across NCIQ five subdomains for all 50-survey items. This figure highlights differences between the two patients on mean scores for each subdomain: sound perception, psychological functioning, and social functioning. Results of the NCIQ revealed differences between Patient A and B on overall mean scores for four of the five subdomains (1,2,4, and 5). Subdomain mean scores indicated that Patient A (who had to wait 5 years before being implanted) was having more difficulties with QoL issues than Patient B (who was implanted immediately after the sudden loss of her hearing). Patient A and B scored similarly on survey items related to *Self-esteem* (subdomain 3). However, self esteem mean scores for both patients were low (between 32-40%).

Psychological functioning (self-esteem)

In the *Psychological functioning/self-esteem* subdomain, low scores on items indicated more difficulty with psychological functional and lower self-esteem. Mean scores across all ten items for both patients were 40% or below, that demonstrated each patient's perception of hearing loss as undermining her self-confidence (Table 1). Responses to selected questions indicated each patient's perception of annoyance with their hearing loss and frustration in not being able to follow conversations. Patient B indicated that she felt more at ease in company with others while experiencing a greater awareness that her hearing loss was undermining her confidence in conversational communication settings. Patient A indicated that she was more bothered with her hearing loss, more irritated in not being able to follow a conversation, and her hearing loss undermined her self-confidence more than that of Patient B.

Social functioning: activity and social interaction

For activity and social interaction subdomain questions, a lower score to an item indicated better social functioning. The mean score for the two social functioning subdomains were lower for Patient B (Figure 2). Patient A's responses were higher indicating that she experienced more social limitations than those

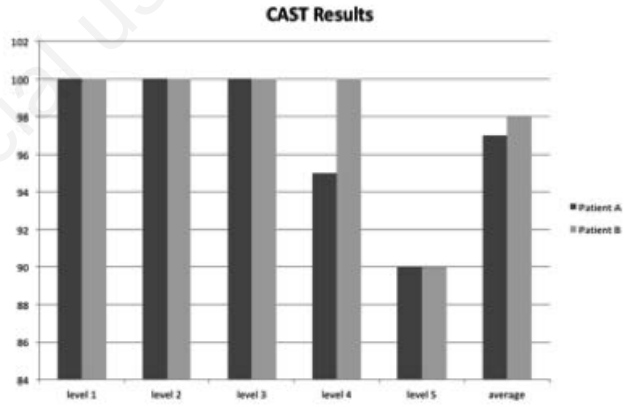

Figure 1. Percentage of correct responses of two patients on the CAST.

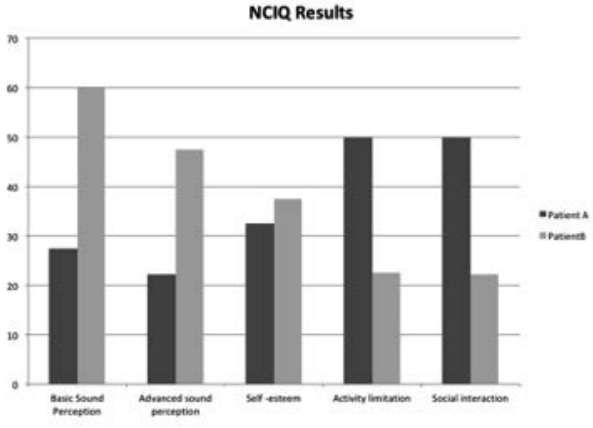

Figure 2. Scores of two patients on five NCIQ subdomains.

expressed by Patient B. Patient A (delayed implantation) also reported a more frequent perception that her hearing loss presented a serious problem when listening with her implant in a group setting. She also indicated that she felt left aside in such settings because of her hearing loss.

Conclusions

Results highlight the following recommendations for optimal AR practices for LDA patients with CIs:

1. Performance on speech perception tests is currently the clinical standard of care for assessing LDAs with CIs. Researchers such as Bodmer *et al.*[5] and Klop *et al*.[9] have also demonstrated that a functional relationship/correlation exists between the duration of *deafness* and an individual's performance on *speech perception listening tests*. However, in this case report, the duration of hearing deprivation did not predict performance on traditional speech perception tests. The LDA patients with CIs with varying durations of hearing deprivation had similar high CAST speech perception scores.
2. Both patients were classified by their hearing professionals as *poor performers*, with each patient reporting dissatisfaction and challenges in listening and functioning with their hearing devices. Results from the CAST did not reveal challenges in basic and advanced speech perception nor could such an instrument assess the ongoing QoL challenges these patients were experiencing in learning to listen anew with a biomedical device. These findings are congruent with the reports by Bodmer *et al*.[5] and Capretta *et al.*[6] that speech recognition test results alone cannot provide hearing health professionals with information regarding the impact of hearing loss on an individual's daily life.
3. Results of this case report demonstrated that the NCIQ provides a rich source of patient qualitative information beyond speech perception testing result. The findings in this case study are consistent with the purpose for which Hinderink *et al*. developed the NCIQ.[8] In this case report we found that the NCIQ provided a more comprehensive assessment of each patient's perception of her hearing loss within the construct of a bio-psychosocial person-centered model of AR.[10-12] Hence, tools such as the NCIQ can provide hearing professionals with a more holistic view of their patients' perceptions regarding the effects and challenges of hearing loss as they progress through their CI AR journey. Such qualitative information is essential in planning and delivering person-centered AR for LDA patients.[13,14]

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