

# Experiences with bimodal hearing and bilateral cochlear implantation in the elderly

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## Background

With the geriatric population being the fastest growing segment of our society the number of elderly people with different levels of hearing impairments is increasing. According to the German Society of Hearing Impaired there are concerned 37% of the 60-69-year-old and 54% of the over 70-year-old. Furthermore the needs of the elderly are changing with augmented social activity and agility compared to former times: 80 is the new 70. After initial concerns about poor audiologic performance and added peri- and postoperative risks because of comorbidities, cochlear implantation is becoming more and more the method of choice also for postlingually deaf people of higher age. With the demographic shift there can be observed a trend reversal: the proportion of implantees is sliding from the young to the senior and duration of deafness at the time of implantation is declining (Battmer 2010). It is therefore necessary to investigate the impact of cochlear implantation on audiologic performance and quality of life in this growing age group.

## Methods

To answer this question we arranged a retrospective study which included 25 elderly who deafened postlingually. At the time of surgery

the patients were aged between 70 and 89 years. The hearing history was quite inhomogeneous with a duration of deafness between less than one and more than 50 years. In most cases there was a slow progression of hearing impairment over a different period of time, only three patients went deaf suddenly. Two patients suffered from their disability since early childhood. There were various comorbidities like hypertension, coronary heart disease, diabetes or chronic pulmonary disease in 17 patients. To evaluate the audiologic performance there was selected a battery of speech perception tests: the Freiburger mono- and bisyllables and the HSM-sentence test. These tests were carried out in quiet and noise 1, 3, 6 and 12 months after the first fit of the cochlear implant. Besides the patients had to answer a questionnaire with the aim to evaluate their hearing handicap before and after cochlear implantation.

## Results

The fastest improvement of the audiologic performance happens within the first three months after the first fit: Freiburger monosyllables (in quiet, 65dB) nearly double from 16 % (+/-26 SD) one month after the first fit up to 29,4% (+/-26 SD) after 3 months (Figure 1). The results in noise and in the HSM sentence test are analogue. The range of benefit depends very much from individual hearing history. Patients whose duration of deafness was comparatively short had a superiorly better chance to reach satisfactory test results. 24% of the implantees even met the category *high-performer*, which means they reach more than 80% monosyllables in quiet. 15 patients were able to communicate via telephone and 13 patients report about a satisfying music perception.

When fitting the second cochlear implant in the group of bilaterally implanted patients (n=5) a near-maximum benefit in speech perception tests was reached after three months. The training curve was definitely steeper compared to the process of fitting the first implant.

Another group of patients were those with a bimodal supply: twelve implantees reported to be a hearing aid user on the contralateral ear further on. What they experienced to be extraordinarily positive was the *very natural sound quality* when using a hearing aid on the contralateral ear. Moreover there can be observed a better performance under bimodal conditions compared to cochlear implant only both in quiet and noise.

To evaluate the impact of cochlear implants on the hearing handicap there was used a questionnaire, the *Hearing handicap inventory for the elderly (HHIE)* (Ventry and Weinstein, 1982) which was adapted to the German language in 1996 by Bertoli *et al.* It consists of 12 questions which refer to social and situational effects. Thirteen questions regard emotional aspects of hearing impairment. As is known the subjective impression of hearing handicap is only partly affected by the severity of hearing loss. Further important factors are personality, emotional state, the requirement of communication, social surround-

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Key words: hearing impairment, cochlear implants, elderly.

Acknowledgements: This work was performed in the framework of the European project "AHEAD III: Assessment of Hearing in the Elderly: Aging and Degeneration - Integration through Immediate Intervention" (2008-2011) (FP7, contract No.HEALTH-F2-2008-200835).

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Licensee PAGEPress, Italy  
Audiology Research 2011; 1:e23  
doi:10.4081/audiores.2011.e23

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Parts of this work were presented at the "AHS 2010 - International Conference on Adult Hearing Screening", Cernobbio (Italy), June 10-12, 2010.

ings and interaction between the person concerned and environment.

The HHIE showed significant improvements in total score and there was a switch from a severe handicap preoperatively to a medium handicap with cochlear implant (Figure 2). There was no correlation in speech performance and individual feeling of being handicapped.

## Discussion

According to Battmer 2010 there are a few former studies which investigate the performance of elderly implantees. 6 of 7 surveys

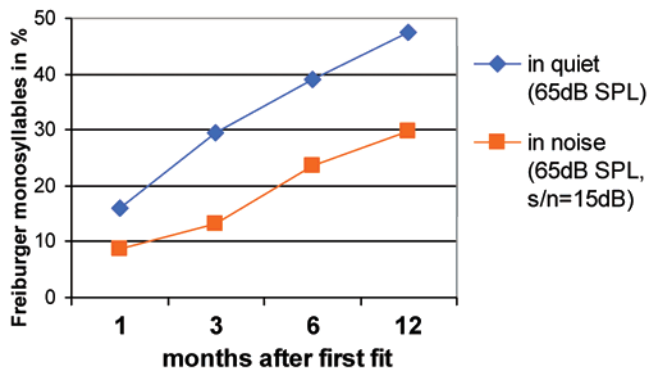


Figure 1. Freiburger monosyllables (65 dB SPL) in quiet and noise (s/n=15dB) 1, 3, 6 and 12 months after first fit.

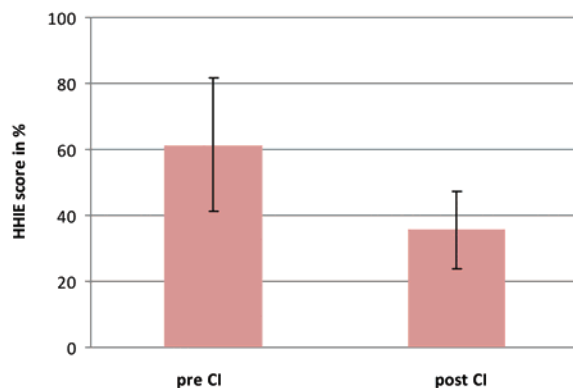


Figure 2. Score (in %) of the *Hearing handicap inventory for the elderly* before (pre) and after (post) cochlear implantation: there is a significant reduction in hearing handicap  $P < 0.01$ .

excluded a statistically significant difference in the audiologic benefit of the group of the young and elderly. Compatible to that we found a definite improvement of the audiologic performance during the first twelve months after cochlear implantation in patients aged over 70 years. We agree with Leung (*et al.*, 2005) that duration of deafness along with the percentage of life lived deaf hold greater predictive power than age, demonstrating that residual hearing capacity and language abilities may hold the key to postoperative success in the elderly cochlear implant recipient. At the same time speech perception benefits of the older implantees showed large subject variability which can be explained by such factors as cause and duration of deafness, hearing aid user prior to cochlear implantation, motivation, family and environmental support. A further aspect which has not been evaluated until now was the development of audiologic performance after bilateral cochlear implantation in patients older than 70 years. The near maximum benefit was reached after a shorter period of time compared to the process of fitting the first cochlear implant. A coherence with still available neuroplasticity stands to reason. Besides the use of a hearing aid on the contralateral ear offered a particular advantage compared to the use of the cochlear implant only both in audiologic performance and quality of life. It is remarkable that the audiologic handicap measured by the HHIE questionnaire decreased significantly from a severe to a medium handicap after the supply with a cochlear implant. But there was no correlation between the audiologic performance and the individual feeling of being handicapped. In essence elderly patients show particular benefit after bimodal or bilateral supply. There is a distinct positive effect on quality of life and preservation of their social independence.

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