# Which is Better: Bilateral Implants or a Unilateral Implant with an Acoustic Hearing Aid?

A summary of a presentation given at the Summer Meeting 2010 by Professor Quentin Summerfield, Department of Psychology, University of York

The debate about whether unilateral implant users are better off with another implant in the contralateral ear (bilateral) or with an acoustic hearing aid (bimodal) continues and more research results are now available on the merits of these two approaches. Professor Summerfield emphasised from the start that the option to use a hearing aid was dependent on there being some, even if very little, residual hearing in the unimplanted ear.

Cochlear implants are wonderful but they don't restore normal hearing because they only provide useful information from the middle frequency range up to the higher frequencies and thus an acoustic hearing aid might be able to 'fill in' the lower frequencies. Recent research from the University of Arizona led by Michael Dorman and his colleagues has explored this topic (see Figure 1).



Using a hearing aid (HA) alone users achieved negligible accuracy of speech perception of spoken words when information below 500 Hz was provided, and only 45% when information up to 1 kHz was provided. Their scores improved to 55% correct using a unilateral implant (CI) alone. Dramatically, however, speech perception performance rose to 75% correct using a CI + HA, even when only a small amount of acoustic information below 125Hz was provided. When acoustic information up to 1kHz was provided,



Quentin Summerfield

accuracy reached 90% correct. The conclusion is that even a small amount of low-frequency acoustic hearing in the other ear may improve the accuracy of speech perception with a Cl. Asked about the lowest level of hearing loss in the unimplanted ear above which an HA might give these benefits, Professor Summerfield stated that an average hearing level of 115 dB (averaged over the frequencies from 250 Hz to 4 kHz, inclusive) would be the lowest limit. He added that modern digital hearing aids can often deliver amplification at low frequencies without the distortion that was present in earlier devices.

Quentin then presented evidence of simulations to establish whether emotion in the spoken word can be identified more actively between the two modes of CI + CI and CI + HA. The conclusion was that identification of emotion in speech may be more accurate with a CA + HA than with a CI + CI.

Turning to the bilateral approach and what might the second implant add to a first implant (see figure 2)

# What might a second implant add to a first implant?

- Guarantee that the 'better ear' is implanted
- Insurance policy
- Potential to restore abilities in 'spatial listening'
  - More accurate localisation of sound
  - More accurate speech perception in noise

Fig 2

recent research by Rosie Lovett (University of York) on the accuracy of localisation of sounds by children who were bilaterally implanted (CI + CI) shows that two implants outperformed one implant with a hearing aid (CI + HA)- see Figure 3.

#### Accuracy of localising sounds



Concerning speech perception in noisy environments Quentin explored the different configurations to show the effects of spatial release from masking. This arises because the user's head shields the implanted ear from noise and thus the accuracy of speech perception improves when the noise source is on the opposite side of the head to the implant. The conclusions were that the benefits of bilateral implants (CI + CI) showed that spatial release from masking occurs when the noise is moved to either side of the head whereas for users of the CI + HA then spatial release from masking only occurs when the noise is moved to the side away from their implant. Quentin drew all these developments and conclusions together and explained the advantages and disadvantages between the two considered situations (see Figure 4).

#### Advantages and Disadvantages

- Better with CI+HA than CI+CI
- Speech understanding (in quiet and when speech and noise come from the <u>same</u> location)
- Perception of emotion in speech
- Perception of melody in music
- Better with CI+CI than CI+HA – Localisation of sound
- Speech understanding (when speech and noise come from <u>different</u> locations)
- Tracking moving sounds Fig 4

Professor Summerfield then announced the aims of the new study of adults that he and his research team would be conducting to establish not only the differences in listening skills but also the quality of life between the three conditions of a unilateral implant, an implant plus a hearing aid, and bilateral implants. The research study will establish the advantages and disadvantages all three modes and, importantly, how much the differences matter to the adult users. He explained that the research would be conducted in York and volunteers would have all travel and accommodation expenses paid for their visit during which there would be up to six hours of evaluation and tests. Any adult members of the Association who routinely use bilateral implants, or an implant and a hearing aid, and who might like to take part should contact Dr Pádraig Kitterick (p.kitterick@psych.york.ac.uk) to learn what would be involved, if they are not already in correspondence with Professor Summerfield.

Earlier AQS explained that following the NICE recommendation that a randomised controlled trial should be carried out to examine the benefit cochlear implantation compared with unilateral implantation in adults with severe to profound deafness, he and his fellow professionals across the UK had developed a comprehensive plan to conduct this research but it had been rejected on the basis that "it was too expensive and that the case of need was not as strong as some other applications for funding".

## Contributions

In his reminder letter in March to members to renew their subscription to our Association Paul Tomlinson, Treasurer, asked if members would consider making an additional payment as a contribution to our modest funds. A number of members responded to this general appeal and Paul, on behalf of the Executive Committee, wishes to thanks all those who contributed in this way. Their donations are very much appreciated.

### **Diary Date**

13 November 2010 Winter Forum SOECIC Southampton

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