

REPORT AND ASSESSMENT OF A STUDY OF 10 ADULTS USING COCHLEAR IMPLANTS AND COMFORT AUDIO CONFERENCE MICROPHONES

How can speech intelligibility be improved for adults using conference microphones?

By Anna K Lejon, February 2013

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Abstract:

Being part of a community of colleagues at work is taken for granted by persons with normal hearing who participate in discussions and meetings.

Meetings are important in life and often include small talk that may inspire and motivate participants.

But what is it like to take part in a meeting as a Cochlear Implant user?

Using cochlear implants as an adult

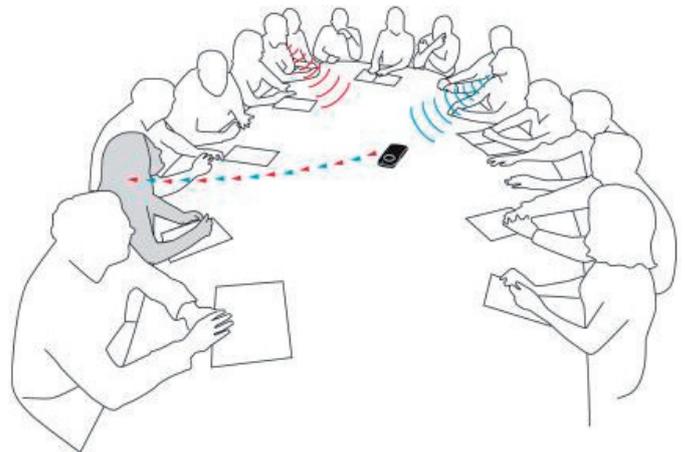
Many CI-users who receive their implant as an adult are very satisfied with the improvement of their life. They manage work and social life better than before they had a CI. (Hardeveld, 2012) Following conversations in quiet surroundings is not difficult. However, speech recognition deteriorates rapidly as the level of background noise increases. (Qian-J., F, Nogaki G., 2005)

To be a part of a discussion

Effective communication at work means active participation in discussions or meetings in the same way that those with normal hearing. Assisting those with impaired hearing by passing microphones between speakers can be a challenge that requires discipline and patience of all participants. Discussions are often stilted as conversations pause when speakers wait their turns with the microphone.

Placing a conference microphone in the center of seated participants round a table requires no effort, and many users find the meeting more natural.

Comfort Audio offers two conference microphones to solve complex meetings for persons with a hearing loss: Comfort Digisystem Microphone DC10 and DC20.



The illustration shows how a Comfort Digisystem conference microphone picks up sound from around the table, transmitting the signal digitally to the user.

Using CI and Comfort Audio conference microphones

A study using a CI in combination with a Comfort Digisystem conference microphone was performed at the Institute of Physiology and Pathology of Hearing, Warsaw, and the Institute of Sensory Organs, Nadarzyn, in Poland. The study was organized by Olszewski Ł., Majchrzak A., and Skarżyński P.H.

Objective

The objective of the study was to record the effect of using a Comfort Digisystem conference microphone incorporating active Perceptual Speech Enhancement (PSE), in combination with cochlear implants in adults. In the study, 10 adult CI-users were tested with a range of CI experience from 18 months to 7 years.

Test set-up

The study was set up to determine how use of a conference microphone affects speech intelligibility. The CI participants were evaluated, each subject listening to the Matrix test using their CI alone and their CI in combination with a Comfort Digisystem conference microphone. Measurement of the signal-to-noise ratio (SNR) was recorded and correlated with correct understanding of 50% of the words from the Matrix test. The test was performed in an audiometric booth, approximately 2x3 meters in size. The Matrix test was produced from a loud speaker placed 1 meter in front of the user or the conference microphone.

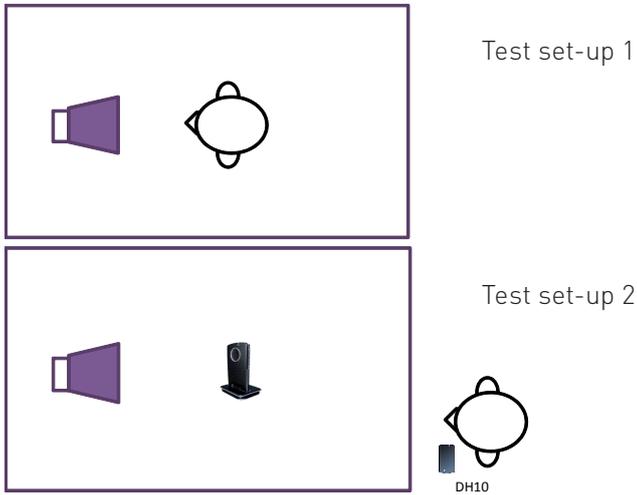
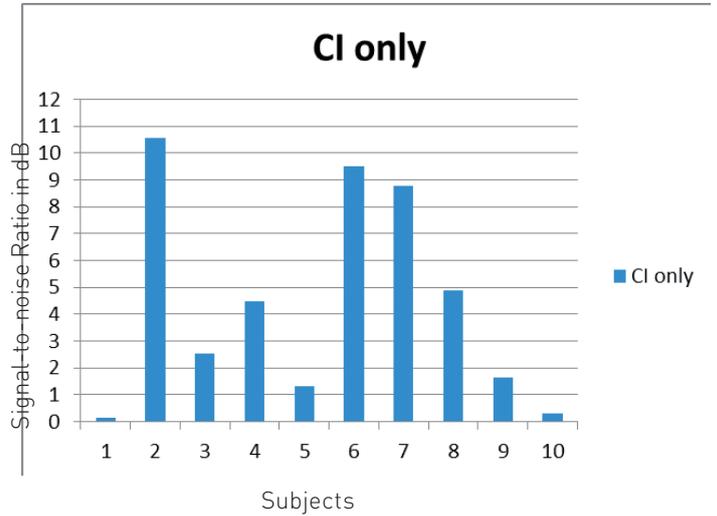


Illustration of the two set up tests used in the study. In Set-up 1, the subject uses a cochlear implant only; in Set-up 2, the subject uses a cochlear implant in combination with a Comfort Digisystem Conference Microphone and a neckloop receiver

The test set-up was chosen to record the effect of the active Perceptual Speech Enhancement algorithm of Comfort Digisystem conference microphones. The conference microphone is placed between the sound source and subject as shown, which would be normal practice for hearing impaired listeners.

Outcomes using a cochlear implant only

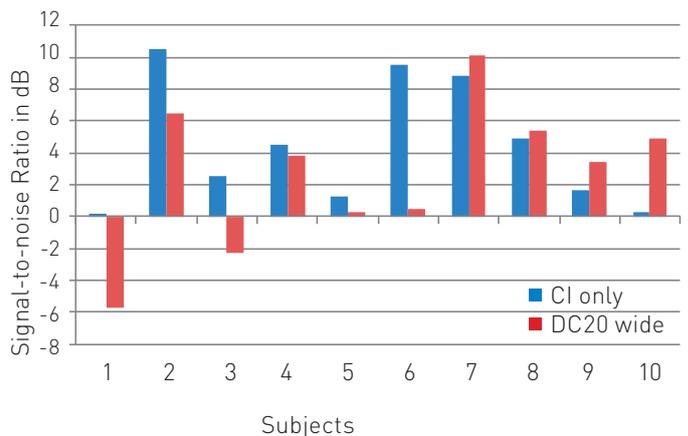
The initial stage of the study was to determine the SNR for the each subject to understand 50% of the words. The results show that the ten CI-users differ considerably in the SNR they needed to meet the critical figure. The lower the SNR, the easier words were understood by the subject amongst the noise.



Graph of SNRs the 10 subjects required to understand 50% of Matrix test in noise.

Outcomes using a cochlear implant in combination with a conference microphone

After determining the signal-to-noise ratio outcomes of the subjects equipped with cochlear implants alone, the test was repeated in Set Up 2 with a Comfort Digisystem Conference Microphone and a neckloop receiver. The results in this test also showed large individual differences.



Graph illustrates the change the of SNRs of the 10 subjects from CI only (Blue) to using a Comfort Digisystem Conference Microphone DC20 (Red).

Discussion

Six of the ten subjects had improved SNR Matrix intelligibility using the Conference Microphone DC20. The improvement range was 0.7 to 9.0 dB, an average of 4.24dB. Four subjects did not improve their SNR Matrix intelligibility when using the conference microphone. Improvement, or lack of improvement, is shown in the table below together with CI processor employed.

Test person	1	2	3	4	5	6	7	8	9	10
Improvement in dB	5.8	4.05	4.85	0.7	1.05	9.0	-1.3	-0.45	-1.8	-4.6
Processor	Freedom	3G	3G	Opus 2	Opus 2	Opus 2	Duet 2	Duet 2	CP810	Freedom

Table of each subject's improvement in dB, when using a Comfort Digisystem Conference Microphone DC20 compared to cochlear implant only. The processor that each subject's CI used is also tabulated.

The CI-processor could be a factor causing the variation in outcomes and suggests further investigation is necessary. Other factors may include familiarity with Comfort Audio Perceptual Speech Enhancement, indicating a period of adaptation may be required, and the use of a conference microphone that no subject had previously experienced.

Another parameter that may affect the study's outcome is the subject's usual method of communication, oral or sign language.

References

Van Hardeveld, Ruud: *Quality of life of adult CI-users*. ONICI 2012.

Qian-J, F , Nogaki G: *Noise Susceptibility of Cochlear Implant Users: The Role of Spectral Resolution and Smearing*. Journal of the Association for Research in Otolaryngology 2005, Volume 6.