Field Study News

October 2013

Phonak DECT CP1 cordless phone

Improvement of speech intelligibility and client satisfaction

Use of the Phonak DECT CP1 cordless phone improves the average speech reception threshold (SRT) by 9 dB compared to use of a standard phone. Subjective client satisfaction with the Phonak DECT CP1 cordless phone is significantly higher than with a standard phone. These improvements can be attributed to: receiving the phone signal in both ears as opposed to just one, the attenuation of the background noise and the easier positioning of the phone receiver.

Objective

The objective of this study was to investigate whether use of the Phonak DECT CP1 cordless phone, in a situation with background noise would result in improved speech intelligibility when compared with use of a standard phone. A second objective was to compare user satisfaction when using the Phonak DECT CP1 versus a standard phone.

Introduction

Hearing on the telephone is a common challenge for hearing aid wearers. In fact, different surveys report that one in five hearing aid wearers are dissatisfied when using the telephone with a hearing aid (Latzel 2001, Kochkin 2005). The difficulty which hearing aid wearers face when using the phone is thought to be due to a number of factors; the lack of visual clues, reduced frequency bandwidth (approximately 300 to 3300 Hz), monaural listening, the presence of background noise and difficulty coupling the phone to the hearing aid.

Given that there are a variety of needs when using the telephone, Phonak offers a variety of solutions. The acoustic phone program, with its optimized frequency response and compression setting, has the advantage that it can be used with any phone and is available in every Phonak hearing aid. The telecoil which is available in most hearing aids requires compatible telephones.

With the DuoPhone feature from Phonak, the phone signal is picked up by one hearing aid (via the microphone or telecoil) and is streamed using the proprietary Binaural VoiceStream Technology™ to the hearing aid on the other ear. While streaming, the background noise is attenuated by 6 dB (the amount of attenuation can be adjusted). DuoPhone has been shown to improve speech intelligibility on the phone (Nyfeller 2010). The strength of the DuoPhone solution is that is can be used with any phone, both mobile and landline as long as the feature is available in the hearing aids. DuoPhone is available in many performance levels and models of newer generation hearing aids.

A streaming device, such as the Phonak ComPilot or the new Roger Pen deliver the phone signal from a Bluetooth enabled cell phone to both hearing aids simultaneously. Picou and Ricketts (2011; 2013) reported that speech intelligibility was significantly improved when hearing on the telephone via wireless streaming to both hearing aids by use of a remote interface device, in comparison to when hearing the phone signal monaurally.
The new addition to the Phonak phone solutions is the Phonak DECT CP1. It is the ideal landline phone solution for home or small offices. This state-of-the-art cordless telephone streams the phone signal to both hearing aids and can be used with any wireless Phonak hearing aids back to the CORE platform (launched after 2008). It does not require Bluetooth or any additional streaming devices and is fully automatic i.e. does not require the user to change hearing aid programs. The default 6 dB hearing aid microphone attenuation can be adjusted by the hearing care professional if required. Additionally, the volume of the phone signal can be increased via a volume boost button on the Phonak DECT CP1 if desired. These features help users to hear on the phone even when background noise is present. The Phonak DECT CP1 has the advantage that apart from the streaming function, it also has an acoustic output and it can be used like a regular phone by people who do not wear hearing aids. Furthermore, it offers many features one would expect from a state-of-the-art cordless phone.

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Study Design

Fifteen subjects with moderate-severe hearing loss took part in the study. Subjects had a hearing loss at low-frequencies of at least 45 dB HL and an air-bone gap of not more than 10 dB HL. There were 7 male and 8 female subjects whose age ranged from 57 – 83 years.

All subjects were fitted with Phonak Naída Q90-SP hearing aids which were programmed to first-fit using the Adaptive Phonak Digital fitting formula based on the hearing threshold, air-bone gap and uncomfortable loudness level. The hearing aids were coupled to earmolds without vents and were programmed to have an acoustic phone program where DuoPhone was disabled. This was the program used for the monaural standard phone condition. The hearing aids also had a default streaming program available for the Phonak DECT CP1 which was set to default settings including a microphone attenuation of 6 dB. The study design consisted of two parts: a speech intelligibility test and a questionnaire. For the speech intelligibility test, subjects sat at the center of a circle as can be seen in figure 1. The subjects were surrounded by four speakers at angles of 45°, 135°, 225° and 315°. The speakers each produced the International Speech Test Signal (ISTS) with slightly different delays. This overlapping of the signal produced a diffuse speech-noise environment which changed in level depending on the subjects' answers during the speech intelligibility test in order to obtain an SRT of 50% correct digit recognition.

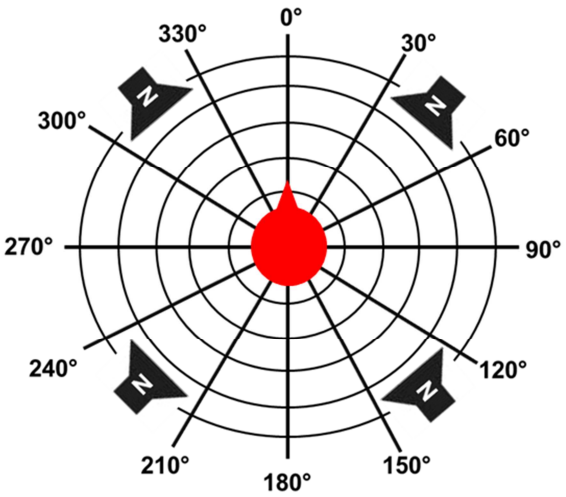

Figure 1. The test setup for the speech intelligibility test. Subjects were seated at the center of the circle surrounded by four speakers producing ISTS noise which adapted in level. Speech material was presented via the phone at a constant level of 65 dB (A).

This setup was selected to mimic the everyday-life situation when during a conversation at home with several people, the phone rings and the hearing aid user tries to make the phone call while the other people in the room continue their conversation. The speech test material used was the Triple-Digit-Test (TDT) (Zokoll et al., (2012; 2013)) which consists of spoken combinations of three digits. This speech material was presented to the subjects via the phone receiver (either a standard acoustic phone or via the Phonak DECT CP1).

The standard acoustic phone used in the study was a Phonak DECT CP1 with the wireless streaming disabled. Without the wireless streaming its output was equivalent to a standard phone and it ensured that the acoustical output for both phone conditions was the same.

Subjects were then asked to type in the digit which they had heard via a touchscreen. The order in which the two phone conditions were tested was randomized. The speech material was calibrated using a Knowles Electronic Manikin for Acoustic Research (KEMAR) in order to present at a constant speech level of 65 dB (A).

Following the speech intelligibility tests, subjective user satisfaction scores were obtained. The questionnaire judged listening effort, sound quality, loudness of speech and noise, effort to find the correct receiver position and overall impression for both the standard phone and for the Phonak DECT CP1.

Results

The results of the speech intelligibility test are summarized in figure 2. The median SRT with use of the standard phone was 5 dB and with use of the Phonak DECT CP1 was -4 dB. This corresponds to an improvement in SRT of 9 dB when using the Phonak DECT CP1. The small variance shows that almost all participants had improved speech intelligibility scores regardless of the individual hearing loss. The result is statistically significant on the 0.005 significance level (Wilcoxon Test).

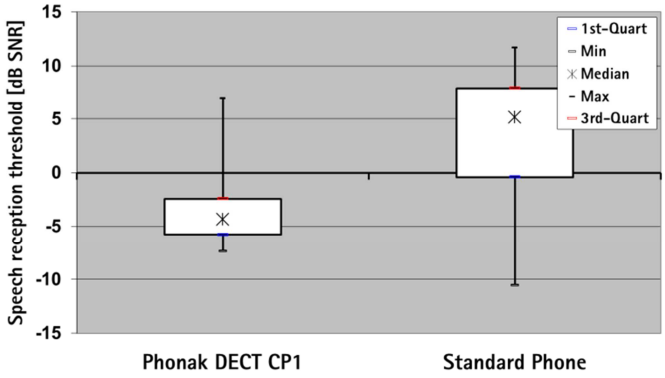

Figure 2. Speech reception thresholds for 50% correct digit recognition in adaptive noise with use of the acoustic phone and the wireless Phonak DECT CP1. The graph shows the median values of the SRT, the 1st and 3rd quartiles and the minimum and maximum values.

Figures 3 and 4 show the results of subjective judgment when using the Phonak DECT CP1 versus the standard phone. Figure 3 shows that finding the best receiver position for the best phone signal was rated as significantly less effort with the Phonak DECT CP1 than with the standard phone. Accurate positioning of a telephone receiver with hearing aids, when the hearing aid microphones are being used is essential. This is the reason why particular precautions must be taken during research involving telephone communication in order to obtain reproducible results (Latzel 2001). The result in figure 3 demonstrates this effect. In the case of the standard phone, the area of maximum sensitivity i.e. near to the microphone, is very small and is therefore difficult to find. This accounts for the poor rating of the standard phone in figure 3. When using the Phonak DECT CP1, this area of maximum sensitivity is fundamentally larger so that an optimal coupling of the speech signal is much easier.

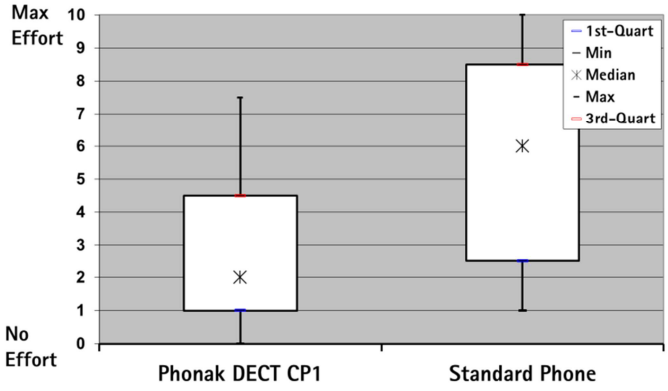

Figure 3. Subjective rating of effort to find correct listening position. Subjects were asked to rate the effort required to find a receiver position where they could hear well for both the Phonak DECT CP1 and for the standard phone on a scale of 0-10. The graph shows the median values of the rating of the effort to find the correct receiver position, the 1st and 3rd quartiles and the minimum and maximum values

Figure 4 shows that subjects rated their overall impression of the Phonak DECT CP1 as significantly better than the standard phone. This can be attributed to very low listening effort, better sound quality and loudness of speech. A recent study showed that the Phonak DECT CP1 is also very easy to use (Stuermann, 2013).

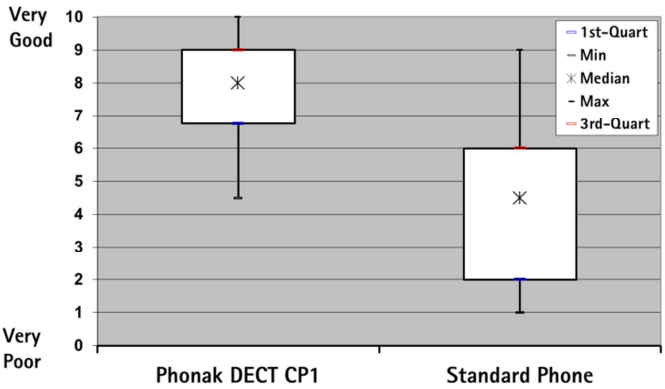

Figure 4. Subjective rating of overall impression. Subjects were asked to rate their overall impression of both the Phonak DECT CP1 and the standard phone on a scale of 0-10. The graph shows the median values of the overall rating, the 1st and 3rd quartiles and the minimum and maximum values

The Phonak DECT CP1 was also rated as significantly better than the standard phone for the dimensions of listening effort, sound quality and loudness of noise. Loudness of speech for the standard phone was rated more in the direction of "too soft" compared to that for the Phonak DECT CP1.

Conclusion

Use of the Phonak DECT CP1 cordless phone resulted in a highly significant 9 dB improvement in the median SRT compared to use of a standard phone. Questionnaires revealed that subjects rated the Phonak DECT CP1 as significantly better than the standard phone in the domains of listening effort, sound quality, effort to find the best receiver position and overall impression. These findings can most likely to be attributed to the fact that with the Phonak DECT CP1, subjects were able to hear the phone signal in both ears. The additional attenuation of the hearing aid microphone sensitivity reduces the competing background noise and improves the signal-to-noise ratio. The streaming of the phone signal to the hearing aids means that the spatial area in which the phone signal can be efficiently received is much larger. This in turn makes positioning of the phone receiver much easier.

Kochkin (2010) has shown that overall satisfaction with hearing aids is dependent on the number of listening situations in which the hearing aids are found to be beneficial. The Phonak DECT CP1 has been proven to be both objectively and subjectively, significantly beneficial to hearing aid wearers when using the phone. Conquering this difficult listening situation is an important step to increasing overall satisfaction with amplification.

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