

Benefits of Wireless Telephone Technologies for Bilaterally Implanted Adults

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Introduction

Cochlear implant (CI) recipients often have difficulty conversing on the telephone, particularly in noise. Successful use of landline and cellular telephones also can be limited because of less-than-optimal phone placement with respect to the sound processor microphone. One solution for recipients of Advanced Bionics cochlear implants may be the use of new streaming technologies from Phonak to improve the ability to talk on the phone. In addition to reducing interference caused by noise, use of these technologies is not strictly placement-dependent and also allows bilateral/bimodal recipients to take advantage of hearing with two ears.

The primary objective of this study was to assess the telephone communication benefits of Phonak's telephone technologies that stream full bandwidth audio signals from ear to ear wirelessly. In addition, a questionnaire for the CI recipient and also their communication partner (when appropriate) evaluated sound quality, ease of use, and perceived benefit for each accessory/technology.

Wireless Telephone Technologies



The Phonak **DECT phone** (digital enhanced cordless telecommunication) looks like a conventional cordless landline telephone, but is a powerful transmitter that wirelessly streams the phone signal directly to one or two Naida CI Q series processors (or a compatible Phonak hearing aid). The streaming uses Phonak's HIBAN (Hearing Instrument Body Area Network) to create a wireless network between the sound processors and the DECT phone. The result is to maximize the speech signal at the input to the sound processor(s) while minimizing surrounding noise.



Phonak **EasyCall** is a wireless accessory that connects any Bluetooth-enabled cell or smart phone to two Naida CI Q series processors (or one Naida processor in combination with a compatible Phonak hearing aid). After picking up the phone, EasyCall uses HIBAN to stream the phone signal directly to both sound processors, thereby improving the sound quality and signal-to-noise ratio (SNR).



DuoPhone is a Phonak Binaural VoiceStream Technology that streams phone calls in real time to both ears simultaneously. With DuoPhone, the signal is captured by the processor microphone on one side and instantaneously is transmitted to the other processor wirelessly. At the same time, the microphone on the side opposite the phone is attenuated to further improve the SNR.

Methods

Subjects are being recruited from Thomas Jefferson University Hospital. To date, subjects include:

- 4 recipients of bilateral Advanced Bionics CII/90K cochlear implants
- 45 years of age or older (mean age 62.5 years)

In addition

- All subjects have at least moderate open-set speech recognition abilities
- All subjects have had exposure to listening environments to be assessed and a willingness to use assistive device technology in everyday listening situations

This ongoing study is capturing data from acute speech testing and from experience questionnaires:

Speech testing

- DECT phone, EasyCall, and DuoPhone were evaluated in the clinic using sentences in quiet and in noise in a sound proof booth. The speech stimuli consisted of the Connected Speech Test (CST) (Cox, et al 1988). The CST sentences were presented to each subject via a cell phone, landline, or DECT phone from a talker using a landline telephone on the other side of the sound proof booth (monitored via a sound level meter, peaking at 60dB A). Noise consisted of multi-talker babble (MTB) presented from loudspeakers located on either side of the subject (+/- 45-degree azimuth) one meter from the location of the subject's head at 55 dB A, calibrated at the location of the subject's head.

- All subjects wore bilateral Naida CI Q90 sound processors. For the Control conditions (quiet and noise), 100% T-Mic was used. For the Experimental conditions (quiet and noise), HIBAN was enabled and a 75/25 HIBAN to microphone mixing ration was used. In the DuoPhone test sessions, a DuoPhone program was created with 100% T-Mic set to their preferred phone listening ear.

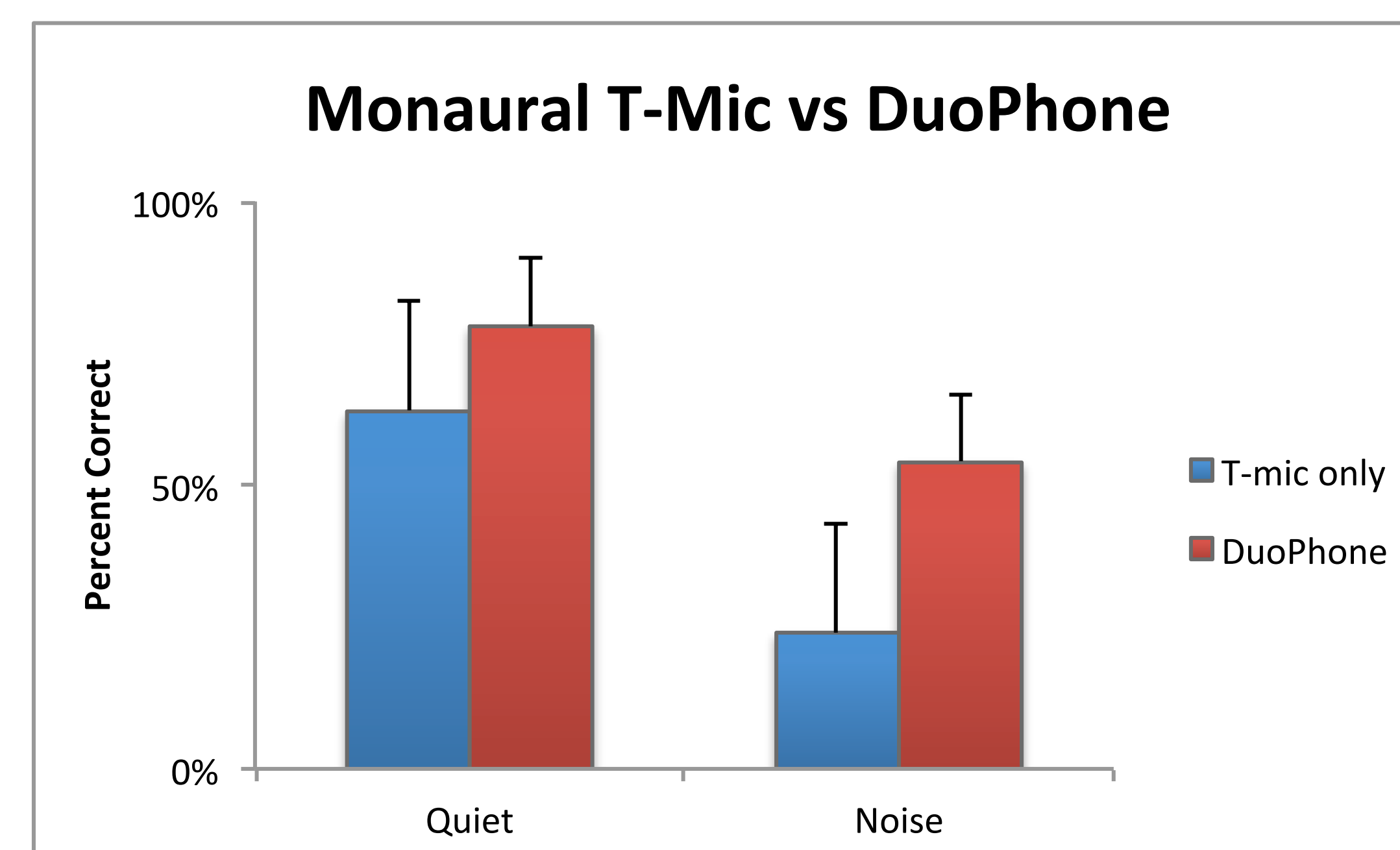
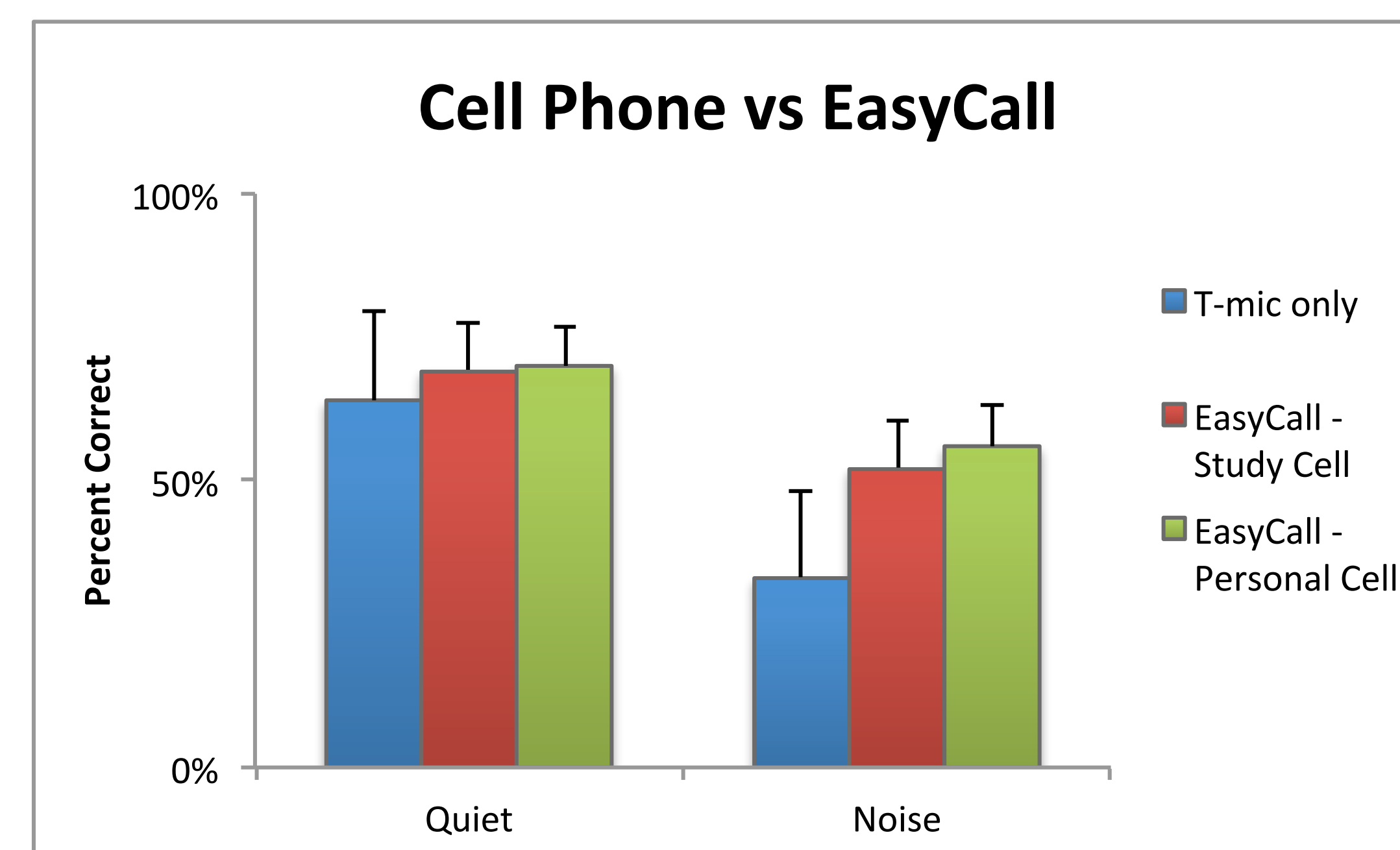
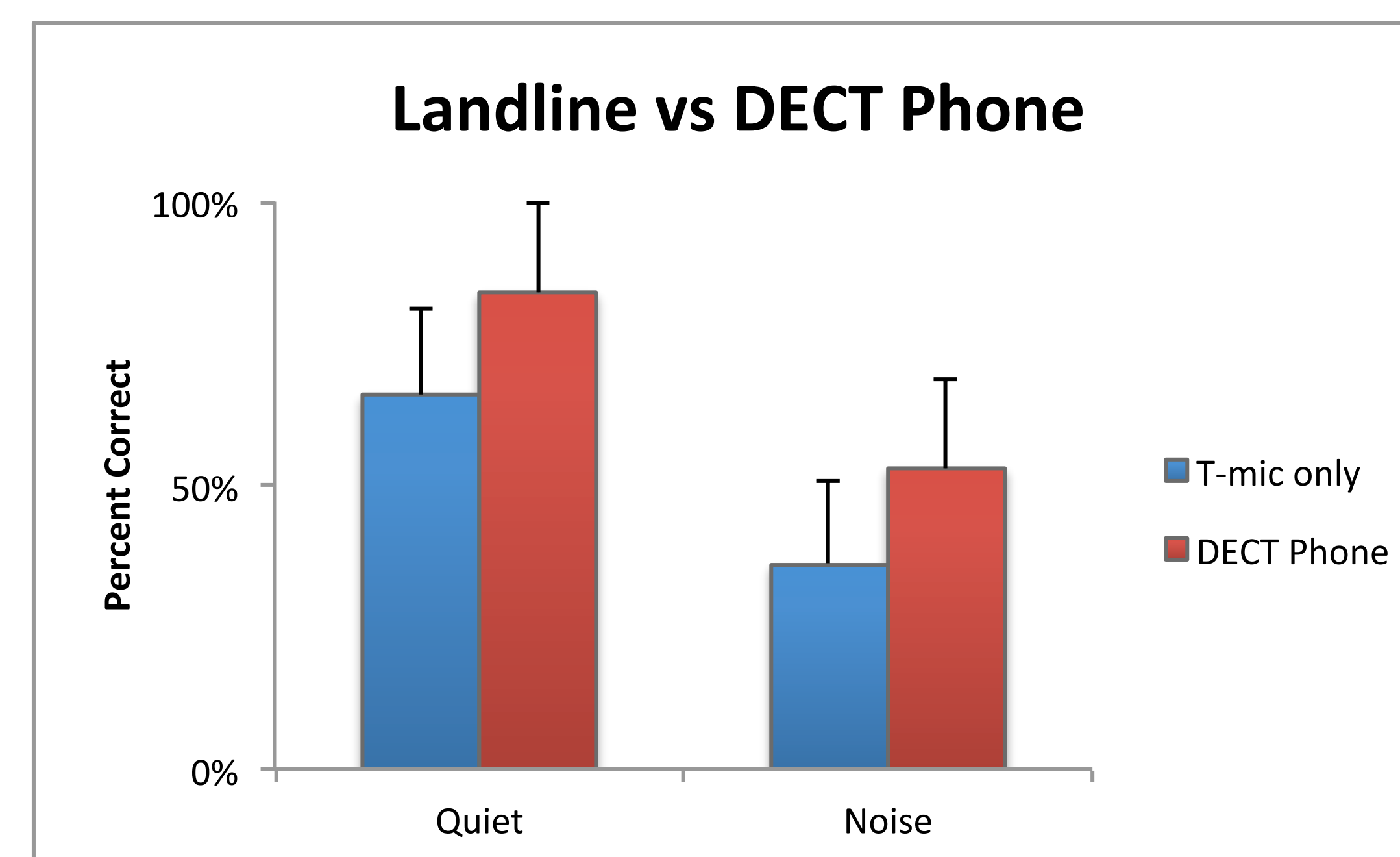
Questionnaires

- Following testing, subjects took the accessory/program home to try in everyday situations for two weeks. After each two-week period, subjects completed a brief questionnaire assessing the sound quality, ease of use, and perceived benefit of use for that accessory/program.
- When appropriate, the primary communication partners completed questionnaires regarding observations about subjects' ease of use and benefits from each technology.

Results

Objective Data:

Each graph shows the average performance in quiet and in noise with monaural (T-Mic only) and binaural (wireless/streaming technologies) listening conditions.



Results suggest that streaming the telephone signal to both ears simultaneously improves the ability to understand speech in quiet and in noise compared to listening in similar conditions with one processor alone.

Questionnaire Data Highlights:

Favorable outcomes

- Prior to this study, most of the subjects used the telephone only in quiet environments or with the help of visual cues (closed caption landline phone).
- Prior to the study, most of the subjects felt only comfortable with one type of telephone, either landline or cell phone. Post study, all subjects felt comfortable and confident using both landline and cell phones.
- All participants and their communication partners felt that the DECT phone, EasyCall, and DuoPhone provided better or equivalent quality of listening environment during phone use.
- Of the three technologies, all participants rated EasyCall as the most beneficial for their needs.
- Communication partners observed that set up of the technologies was easy and that there was an improved phone experience using these technologies.

Unfavorable outcome

- The DECT phone may not be as convenient to use since it is one stationary phone at home whereas the EasyCall is attached to and therefore easily accessible with a cell phone.

Conclusions

Based on our preliminary data, subjects performed better in quiet and in noise when the telephone signal was streamed binaurally through the Phonak wireless technologies rather than monaurally.

Subjects not only performed better, but also had greater confidence using the telephone when given the wireless technologies to aid them.

Of note, two out of the four subjects did not have landline access at home; therefore, they did not try the DECT phone at home. For the other two subjects who did use the DECT phone at home, use of the study DECT phone may have been limited by the easy availability of additional non-DECT telephones in the home.

Future Considerations

More subjects are needed in this study to confirm these preliminary results.

Use of the Phonak wireless technologies is not limited to bilateral CI recipients. Bimodal recipients using an Advanced Bionics cochlear implant and a Phonak hearing aid can also benefit from these technologies and improve their telephone listening experience. Further study could include a set of bimodal users.

References

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