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Spelling with an auditory paradigm was performed in 12 runs. In 9 runs the word was spelled correctly, 1 run was aborted for technical reasons. In all runs, corrections were allowed. Total accuracy over 12 runs was 90.2%. On average 1.3 correct characters were spelled per minute.

DISCUSSION

In this report the user has continued use of the BCI until present, almost three years after she gained reliable control of the BCI and the system was left at her home. Commitment to use an implanted BCI is arguably larger than with a non-invasive BCI, given the required surgery. However, BCI use was mainly associated with failure to use other available methods for communication. The user preferred spelling with the eye-tracker over spelling with the BCI, because of speed of communication. In situations where the eye-tracker was less reliable (outside her home or when problems with her eyelid caused dryness of her eyes), BCI was her primary (and increasingly only) method of communication.
In this study feedback proved to be of quintessential importance to improve on the design of this BCI and BCIs in general. The user requested a function to alert the caregiver, which gave her an improved feeling of safety [4]. She also requested an auditory feedback mode, anticipating loss of control over her eyelids. Continued participation in the study is voluntary and not required for home use. Provisions for post-trial access to intervention, as required in the declaration of Helsinki, are made in this study. The BCI software in this study is developed compliant to the requirements of medical software.

Use of the BCI using an auditory paradigm showed that this compromised speed. The speed of auditory EEG based BCI is reported to be approximately 1 character per min [2]. It has to be noted that the user had ample experience with the BCI with a visual paradigm. It is unknown whether the same speed and accuracy would have been reached without prior visual feedback. These results emphasize a clear need to improve on auditory paradigms.

CONCLUSION

The implanted BCI system proves to be valuable to the user. It functions as a fail-safe method for communication when other AAC technologies are not (or no longer) accessible or available.
Auditory BCI was successful, although at a reduced but encouraging speed, and may give the user reassurance that communication remains possible when control over eyelids fails.

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Boldface names denote co–first authors

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