Introduction

Although the cochlear implant (CI) has been designed primarily to enhance speech communication, many CI candidates express the hope that they will also enjoy music following implantation. However, the currently used CI coding strategies are primarily optimized for speech perception rather than for listening to music, and most CI recipients are not satisfied with the way music is processed and presented. The aim of this study was therefore to find a strategy that is better suited for music perception. Two experiments were carried out:

I. A first approach attempted to improve perception of the place pitch, since without correct pitch perception, it is almost impossible for a CI user to perceive a melody.

II. In a second experiment, selected CI subjects were fitted with a conventional hearing aid on the contralateral ear (‘bimodal stimulation’).

I. Improved Pitch Perception

1. Allocation of the frequencies to the electrodes (CHAR Strategy)

The standard mapping for a Nucleus CI24 implant ranges from 200 Hz to 8 kHz. Based on the cochlear frequency-position function from Greenwood (1990), a more physiological mapping was approximated (Figure 7).

2. FFT Length / Maxima Selection (PEAK Strategy)

With a 128 point FFT and maxima selection based on the energy in the bands, higher harmonics are often not stimulated (Figure 2). A 256 point FFT enhances the representation of the harmonics, and the chance of picking higher harmonics for stimulation increases (Figure 3).

System & Tests

Comparison of coding strategies: Subjective quality test

Paired comparison of a number of music pieces, coded with two different strategies (Figure 5). Goal: To find out which of the strategies sounds more natural.

II. Bimodal Stimulation

Method & Tests

Many CI recipients have residual hearing in the contralateral ear. A conventional hearing aid can provide some low frequency information to this ear, which can improve speech perception. It was however not clear if music perception is also improved by the hearing aid.

Music perception ability was assessed by testing pitch and melody discrimination (Figure 8, after Schupert & Altenmüller, 2001). The tests were carried out in the three conditions CI alone, hearing aid alone, and CI plus hearing aid.

Preliminary Results

So far, only three subjects have been tested. Both pitch and melody perception are improved when using a contralateral hearing aid (Figures 9-10).

Conclusions

I. The paired comparison experiments showed that it would be desirable to have a more extensive training phase with a take-home device. It was not clear if CI recipients would profit from the two new coding strategies when listening to music for a longer time, or also in everyday life situations.

II. Preliminary results showed that CI recipients with some residual hearing in the contralateral ear can profit from a conventional hearing aid in this ear. It remains to be verified if music perception is improved for other than the three pilot subjects.

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References


