SINGLE VERSUS MULTIPLE-CHANNEL ELECTRICAL STIMULATION OF THE AUDITORY NERVE IN SPEECH PROCESSING FOR A TOTALLY DEAF PATIENT

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Auditory neurophysiological studies have provided evidence that frequency is coded on both a place and time basis. Psycho-physical studies on patients with a profound or total postlingual hearing loss have established that electrical stimulation of the auditory nerve can also convey pitch sensations that depend on the place of auditory nerve stimulation. Pitch perception is also related to the rate of stimulation (Tong et al., 1980).

The present study has been undertaken to determine whether a totally deaf patient can integrate both the place and time information from frequency coding in understanding speech signals. Audiological tests were performed to evaluate a totally deaf patient's perception of phonemes, words, and sentences for single-channel stimulation that conveyed the fundamental frequency (FO) as rate of stimulation; and multiple-channel stimulation that presented the fundamental frequency as rate, and the second formant (F2) as place of stimulation. The results shown in the table indicate that multiple-channel stimulation provided significantly better scores than single-channel stimulation when using electrical stimulation alone. Furthermore, all scores were significantly higher when combined with lip-reading, thus indicating the presence of both voicing and place information. On the other hand, multiple-channel stimulation led to the transmission of both voicing and place information.

An information transmission analysis of consonant recognition also confirmed that single-channel stimulation provided voicing but not information about the place of articulation that depends on the second formant. On the other hand, multiple-channel stimulation led to the transmission of both voicing and place information.


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