ELECTROPHONIC RESPONSE CHARACTERISTICS TO ELECTRICAL STIMULATION OF THE COCHLEA

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Speech recognition results of profoundly deaf cochlear implant patients are on average better than those for severely-to-profoundly deaf patients using acoustic hearing aids. It is therefore increasing likely that implant patients may have some residual hearing that could be incorporated into speech processing strategies with the potential to further improve speech recognition. Electrical stimulation of the cochlea results in direct and electrophonic excitation of auditory nerve fibres. Auditory nerve compound action potential (CAP) forward masking studies show the level of frequency specific electrophonic stimulation is highly correlated with the spectral energy of the electrical stimulus waveform. The level of spectral energy in pulsatile biphasic electrical stimuli decreases toward low frequencies suggesting the level of electrophonic stimulation will be diminished in the low frequency region of the cochlea. Due to limitations of CAP forward masking studies, single unit responses in the anteroventral cochlear nucleus (AVCN) of the anesthetised cat were investigated to assess the level of electrophonic stimulation in the low frequency region of the cochlea. Following acoustic characterisation of isolated unit responses, intracochlear bipolar electrical stimuli between 25 and 500,us per phase were presented over an intensity range of 10 to 34 dB (re 1,uA). The electrophonic component of unit responses was separated from that of the direct electrical response based on response latency. Fast Fourier transforms of the response histograms reveal the frequency components of the electrophonic stimulus to which the units are responding. These frequencies corresponded to the maximum spectral input of the electrical stimulus with respect to the units frequency threshold tuning curve. Furthermore, the input-output functions of the electrophonic response showed similar properties to those of acoustic stimuli. An important finding of this study showed that the absolute level of the low frequency electrophonic response was far greater than that predicted from the forward masking studies.

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