Vestibular prosthesis

Prosthetic implantation of the semicircular canals in humans is technically feasible. Electrostimulation resulted in canal-specific eye movements, although thresholds increased over time. Preservation of native auditory and vestibular function, previously observed in animals, was not demonstrated in a single subject with advanced Ménière's disease [1].

Objective:To reveal the response characteristics of semicircular canal neurons（SCN） in the nonlinear perceptual interval, and to establish and screen out the precise SCN information coding model and function expression, which lays a foundation for the optimization and improvement of neuromodulation strategy of multichannel vestibular prosthesis. Method:The perceptual electrophysiological information data of the SCNs during the rotational stimulation was recorded in the nonlinear perceptual interval. The nonlinear least-squares algorithm was used to fit the electrophysiological information data to establish the linear-nonlinear models. The Akaike information criterion was used to calculate the goodness of fit of each model to determine the optimal expression function. Result:In the frequency experiment, the accurate information coding model of more than 85% of SCNs is a quadratic polynomial, and the frequency has no significant effect on the linear-nonlinear selection of the SCNs information coding model（P>0.05）. In the amplitude experiment, the accurate information coding model of more than 83.33% of SCNs is quadratic polynomial when the maximum angular velocity is>80 deg/s, and the amplitude has a significant effect on the linear-nonlinear selection of the SCNs information coding model（P=0.038）. Conclusion:The information coding models of SCN population in the nonlinear perceptual interval have two expressions, linear and nonlinear function, which is closely related to angular velocity. The quadratic polynomial function is more accurate and more advantageous and it can be used to design the precise neuromodulation strategy of multichannel vestibular prosthesis [2].

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2)
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