OLIVOCOCHLEAR AND MIDDLE EAR MUSCLE REFLEX INTERNEURONS IN THE COCHLEAR NUCLEUS

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Introduction

Overview:
This poster presents key results of the study conducted by the Olivocochlear and Middle Ear Muscle (MEM) reflex researchers. The study aimed to identify the neural pathways of these reflexes, ultimately to specify, where exactly, they occur in the nervous system. The results of this research are presented in a schematic overview and detailed in the methods and results sections. The primary goal was to understand the role of MEM reflexes in cochlear function and their potential impact on hearing.

Olivocochlear Reflex: Olivocochlear neurons, originating from the cochlear nucleus, innervate the organ of Corti and regulate inner hair cell (IHC) membrane potential. This reflex provides a mechanism for sound adaptation and plays a significant role in the response to sound (Salomon 1963). Stapedius motoneurons originate around the middle ear muscle (MEM) reflex, which projects to outer hair cells (OHC) of the cochlea. Our metric for activation of the MOC reflex takes place when the OHCs experience a change in their membrane potential, which is detected by the cochlear nucleus (CN). In this study, we explored the role of MOC reflex interneurons in the CN and their potential influence on cochlear function.

Middle Ear Muscle Reflex: The middle ear muscle (MEM) reflex is a significant player in the response to sound. Acoustic overstimulation can cause threshold imbalance and protect the cochlea from damage. In this study, we investigated which neurons of the cochlear nucleus are interneurons, by exploring the role of MOC reflex interneurons in the CN. Stimulation sites were marked by passing DC current and then verified by postexperiment histology, using local injections of xylocaine. Pinnae were removed bilaterally and cochlear nuclei were visualized following fixation. This forms a Prussian blue reaction product at the site of electrical stimulation.

Methods

An experimental procedure was carried out in accordance with the National Institutes of Health guidelines for the care and use of laboratory animals. All measurements were obtained from animals under anesthesia with ketamine (100 mg/kg, intramuscularly) and xylazine (10 mg/kg, intramuscularly). We used anesthetized animals to minimize any potential stress or discomfort. The animals were monitored closely throughout the experiment to ensure their welfare.

Results

Result R1: PVCN stimulation reduced DPOAE level without significant change in the primary tone levels

- PVCN stimulation caused a reduction in DPOAE level (lower trace). Micrograph (lower panel) shows the site of electrical stimulation (marked by the red bar) caused no effect on the primary tone levels (f1, f2 levels) but caused a large reduction in DPOAE level (dB SPL).

Result R2: DCN stimulation did not affect primary tone level or DPOAE level

- Stimulation of site 7 changed both primary and DPOAE levels. Stimulation of site 3 changed the primary tone level but did not affect DPOAE levels. Stimulation of site 5 caused no change in primary or DPOAE levels.

Result R3: Stimulation at some AVCN sites had no effects

- Stimulation of site 6 caused no change in primary tone level or DPOAE level.

Results R4: DCN stimulation generally results in greater reduction of DPOAE in the ipsilateral ear

- Stimulation of the AVCN at site 7 caused a significant reduction in DPOAE level (dB SPL) in the ipsilateral ear.

Summary and conclusion

- PVCN stimulation changed DPOAE without affecting primary tone levels. The MEM reflex, which involves the MOC interneurons, had a significant effect on DPOAE levels but no effect on primary tone levels. This suggests that the MEM reflex is a crucial component in the cochlear function.

- There was greater reduction in DPOAE in the ipsilateral ear than in the contralateral ear. Stimulation of AVCN sites caused a significant change in DPOAE levels in the ipsilateral ear, while stimulation of PVCN sites had no effect.

- Stimulation of some AVCN sites changed primary and DPOAE levels. Some AVCN sites caused a significant change in primary tone levels and DPOAE levels, suggesting that these sites are involved in the regulation of cochlear function.

References