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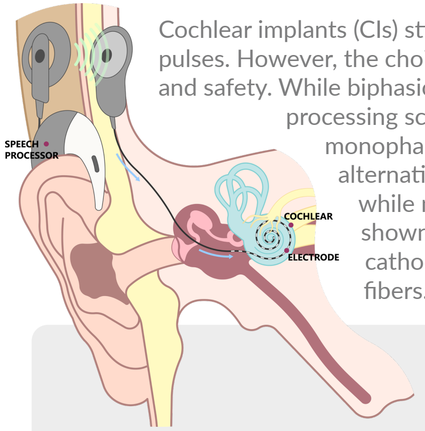
ANODIC-CENTERED ELECTRICAL PULSES MAY IMPROVE PITCH PERCEPTION IN COCHLEAR IMPLANT USERS

BACKGROUND



Cochlear implants (CIs) stimulate the auditory nerve fibers with electrical pulses. However, the choice of pulse type is a balance between effectiveness and safety. While biphasic pulses are the essential pulse shape used in CI processing schemes due to their safety, they are less effective than monophasic pulses. Triphasic pulses have been proposed as an alternative to replicate the effectiveness of monophasic pulses while maintaining safety. In particular, previous research has shown that **anodic-centered triphasic pulses** outperform cathodic-centered pulses in activating the auditory nerve fibers.

OBJECTIVE

This study aimed to explore the potential benefits of using anodic-centered triphasic pulses in comparison to cathodic-centered pulses and biphasic pulses for pitch perception in CI users.

The hypothesis was that the use of anodic-centered triphasic pulses would enhance the pitch perception of CI users.


Biphasic (BP)


Cathodic-Centered Triphasic (C-TP)


Anodic-Centered Triphasic (A-TP)

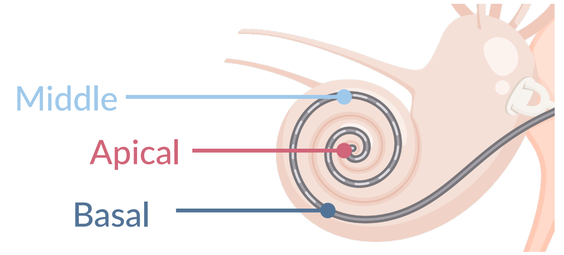
KEY FINDINGS

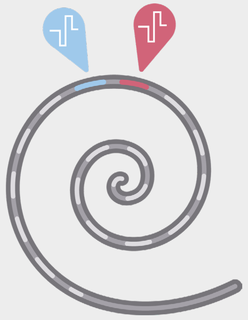
Basal electrodes showed worse pitch ranking thresholds for both AMFR and VCR, likely due to poor neural survival and degraded sound quality in these areas.

Anodic-centered triphasic pulses resulted in significantly better VCR performance compared to cathodic-centered pulses, regardless of electrode location. Although anodic-centered pulses yielded better pitch ranking thresholds than biphasic pulses, the difference was not statistically significant.

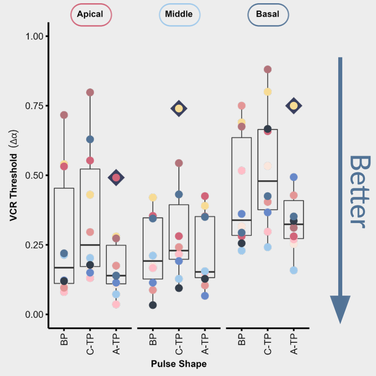
MEASURES & RESULTS

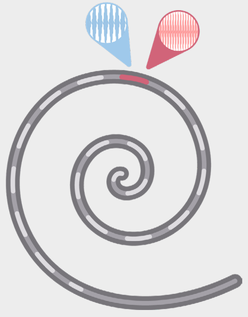
This study included eight adult CI users who underwent pitch ranking tasks using three different pulse shapes: the biphasic pulse, the cathodic-centered triphasic pulse, and the anodic-centered triphasic pulse. Electrodes were selected from the apical, middle, and basal positions of the electrode array in each ear for testing.



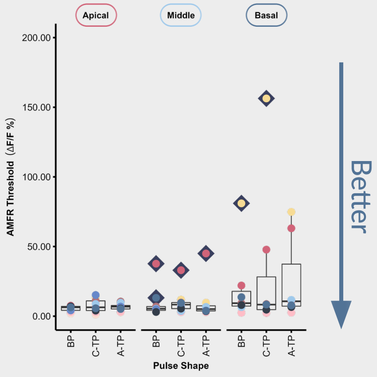


Virtual channel ranking (VCR) measures the ability of CI users to differentiate pitch percepts of sounds delivered through the stimulation of two adjacent electrodes.





Amplitude modulation frequency ranking (AMFR) measures the ability of CI users to distinguish pitch percepts of sounds with different modulation frequencies delivered through the same electrode.



Boxplots show **VCR** and **AMFR** thresholds for three pulse shapes at each electrode location (apical, middle, and basal). X-axis represents pulse shapes: biphasic (BP), cathodic-centered triphasic (C-TP), and anodic-centered triphasic (A-TP), respectively. Each color represents different participant. Black diamonds indicate outliers.