Tuning Cochlear Implants for Improved Pitch Perception: Adjustment of the Frequency Allocation to the Electrodes
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Experiment 1: Frequency Allocation to the Electrodes

Some studies suggest that a frequency map matched to the normal acoustic tonotopic frequencies would be beneficial for cochlear implant users (Baskent and Shannon (2004, 2005 and 2007); Goupell et al. (2008)). However, this may mean truncating the frequency range or deactivating electrodes for individual recipients.

Research Questions:
- Should frequency allocation be adjusted on an individual basis?
  - If yes, how?
  - If no, does the current default map offer optimum performance?

Frequency Allocation Settings
4 settings were compared in this experiment:
- Default map
- Greenwood (normal acoustic tonotopic) map
- Mapping of the Greenwood function to the position of the spiral ganglion (Sridhar et al, 2006)
- Reduced Frequency Range map

Experimental Design:
- Participants tried the default, Greenwood and SG maps for at least 6 weeks but could return to their everyday map if they wished
- Reduced frequency range map tried during the last session only
- BKB sentences in fixed noise performed immediately after fitting and after the acclimatisation period
- Electrode discrimination ability also tested

Participants:
- 12 adult CI users; 10 with good quality X-rays included in the analysis
  - CI for at least 1 year and BKB score > 80% correct in quiet
  - MED-EL device with standard electrode array

Results:
- Limited use of the research maps
  - SG and Greenwood maps rated as having poorer sound quality than the default map
  - No acclimatisation effect observed

Results continued:
- BKB sentence scores worse with the Greenwood map (F(3,24)=21.3, p<0.001)
- 3 participants performed better with the reduced frequency range map (RFR map)
- Improvement with the RFR map associated with poor electrode discrimination score for apical electrodes and deep insertion

Discussion/Conclusions:
- Frequency allocation should be determined on an individual basis
- The insertion angle and a measure of ability to discriminate electrodes may help to optimise the fitting
- The Greenwood function did not represent a matched map for these experienced cochlear implant users

References: