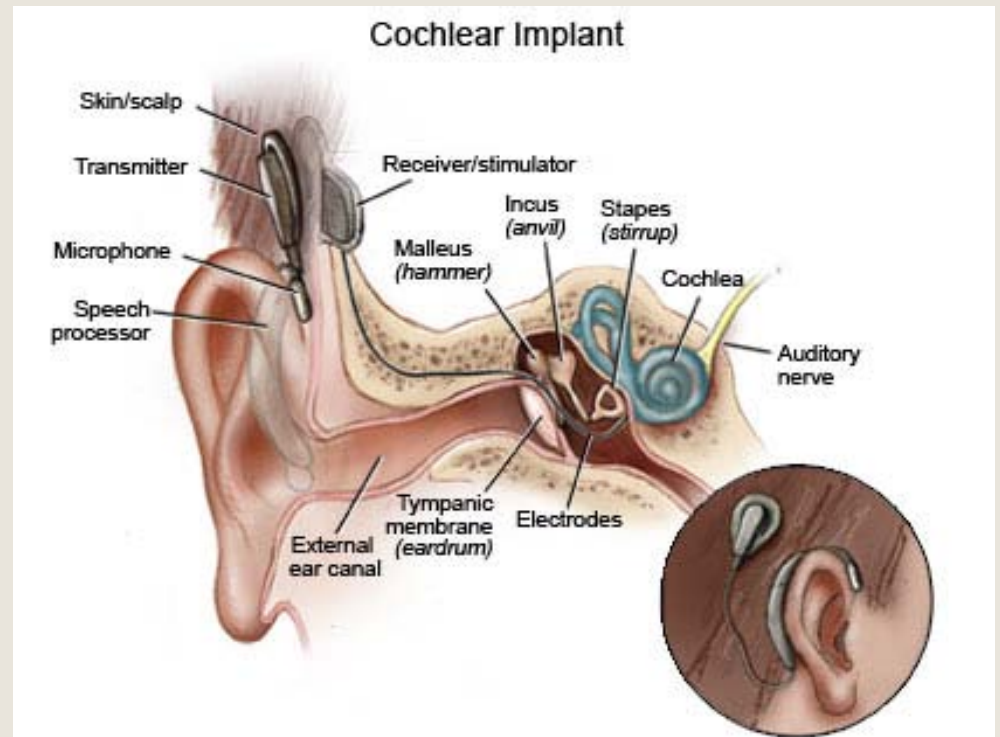


**THE EFFECTS OF
COCHLEAR IMPLANT
THRESHOLD AND
COMFORT LEVELS OVER
TIME**

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COCHLEAR IMPLANTS

- Surgically implanted device that provides access to sound to those who have a severe to profound hearing loss
- Sound is picked up through an external microphone, transmitted to the internal receiver and stimulates nerves used for hearing directly



COCHLEAR IMPLANTS

- Performance with cochlear implants varies considerably between users
- Significant changes in performance are made within the first year of being implanted



COCHLEAR IMPLANTS

- Factors that affect performance
 - Duration of deafness
 - Age of onset of deafness
 - Age at implantation
 - Duration of cochlear implant use

- In the first year after implantation, the user receives several clinical “mapping sessions”
- During these sessions, the audiologist makes changes to the programming of the device to suit the user’s needs and comfort



If so many changes are made to the cochlear implant during the first year of use, how do we know changes in performance are not related to them?

- **Device factors that may affect performance**
 - **Electrode placement**
 - **Electrical dynamic range**
 - **Processing strategy**
 - **Stimulation rate**

THRESHOLD AND COMFORT LEVELS

- The amount of current delivered to each electrode
- Threshold levels are set so that the user can access soft sounds
- Comfort levels are set to the loudest comfortable level for the user
- The range between these two levels is known as the dynamic range

PURPOSE

- To determine the typical changes made to T and C levels over the first year of implant use
- Evaluate typical changes in performance on speech and psychoacoustic detection tasks
- Determine if there is a relationship between T and C levels and cochlear implant performance

METHODS

- Retrospective analysis of data obtained from previous studies
- 5 post-lingually deafened adults who had used a cochlear implant for at least a year
- Compared average T and C levels at 1, 3, 6, 9 and 12 months activation to performance on speech and spectral discrimination tasks

SPEECH TASKS

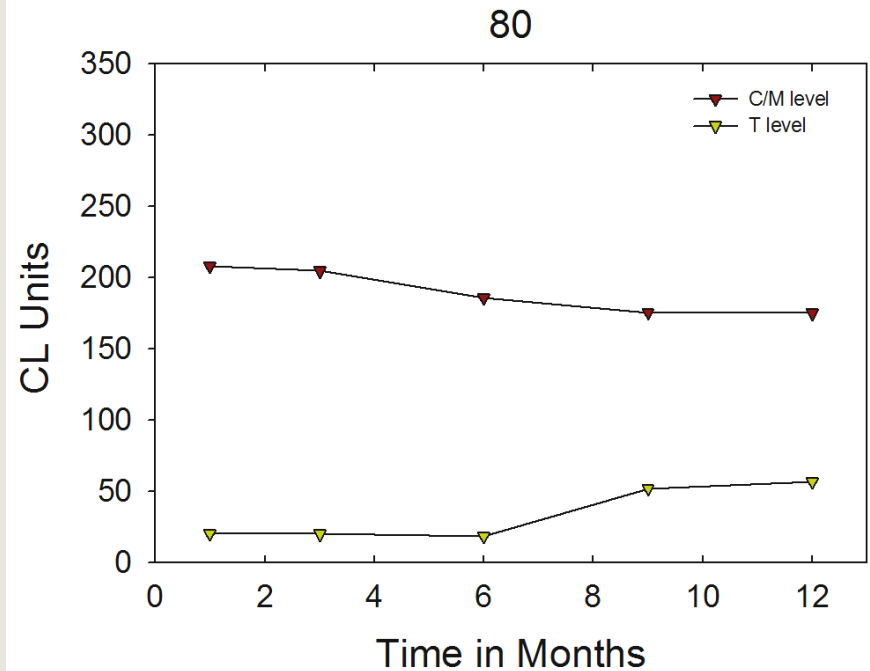
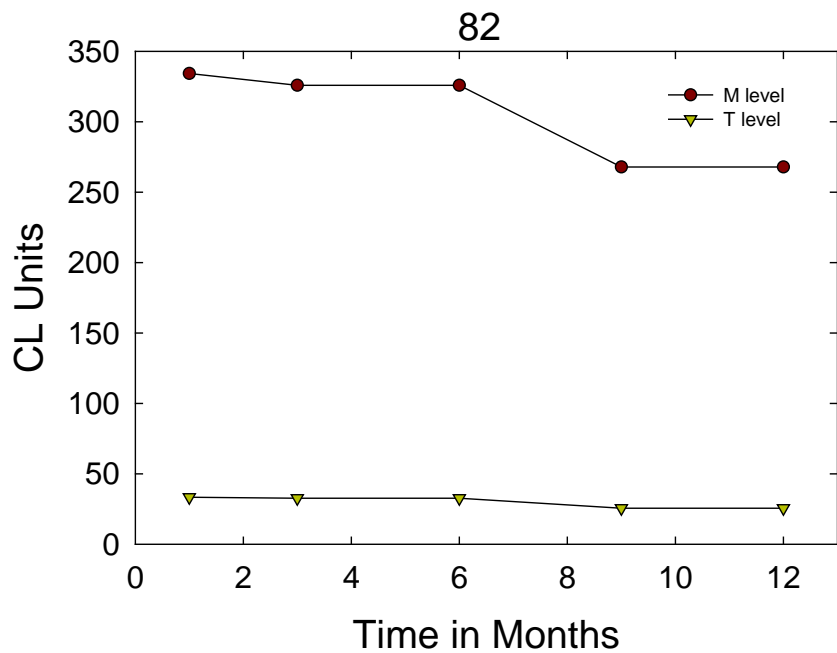
- Consonant-nucleus-consonant (CNC) words
 - Each word contains a consonant followed by a vowel and then another consonant
 - Each word contains 3 phonemes
 - Can be scored for percent of words correct AND percent of phonemes correct
- Hearing in Noise Test (HINT)
 - Tests speech reception in quiet or noise
 - Uses speech-weighted noise

SPECTRAL DISCRIMINATION

- The ability to resolve peaks and patterns in a signal
- Does not depend on how well the user has adjusted to their cochlear implant
- Spectral ripple discrimination task
 - Rippled noise: signal in which the position of the peaks and valleys of a signal alternate
 - Discrimination tasks requires users to detect a reversal in the phase of the rippled shape
 - Correlates with speech perception

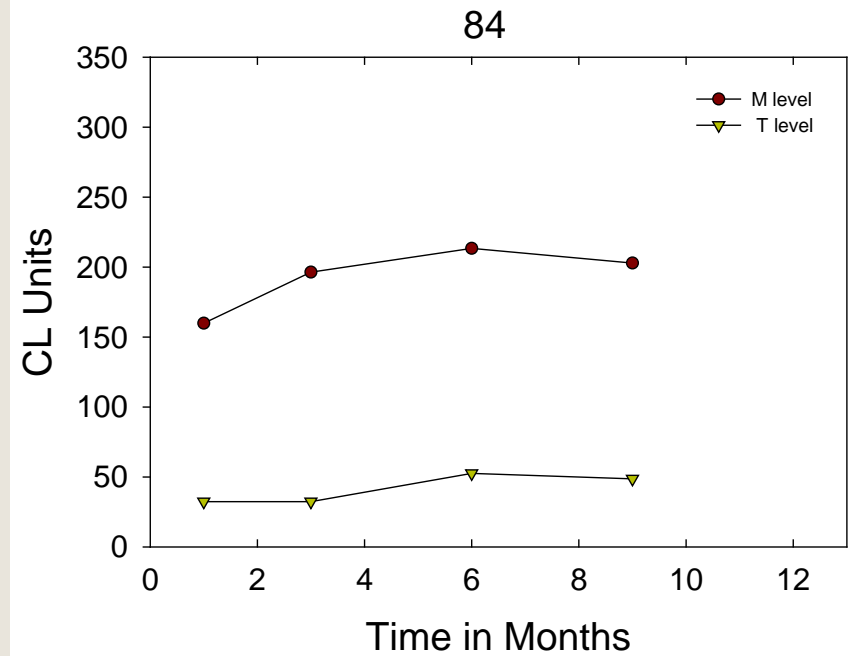
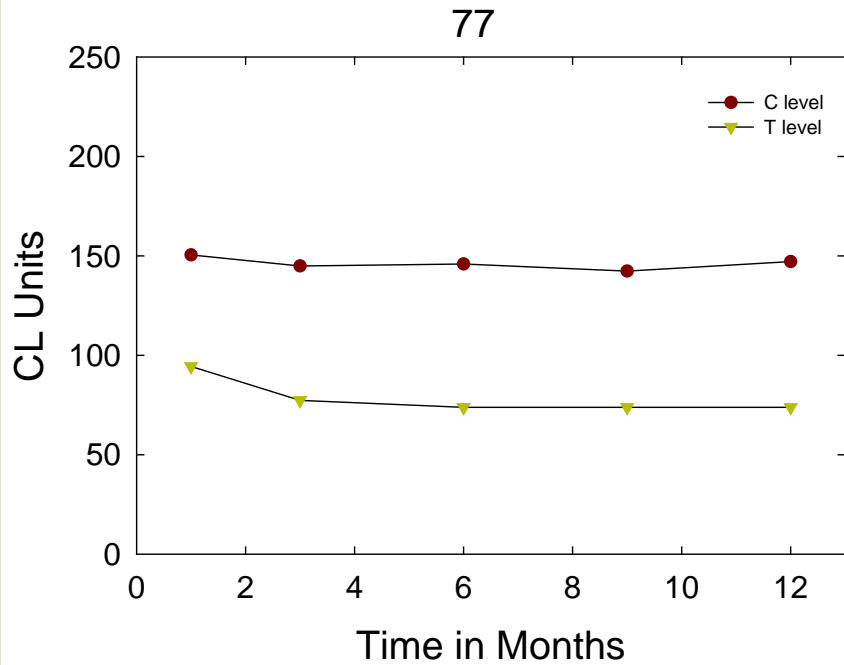
RESULTS

- Two subjects showed a decreased dynamic range over time



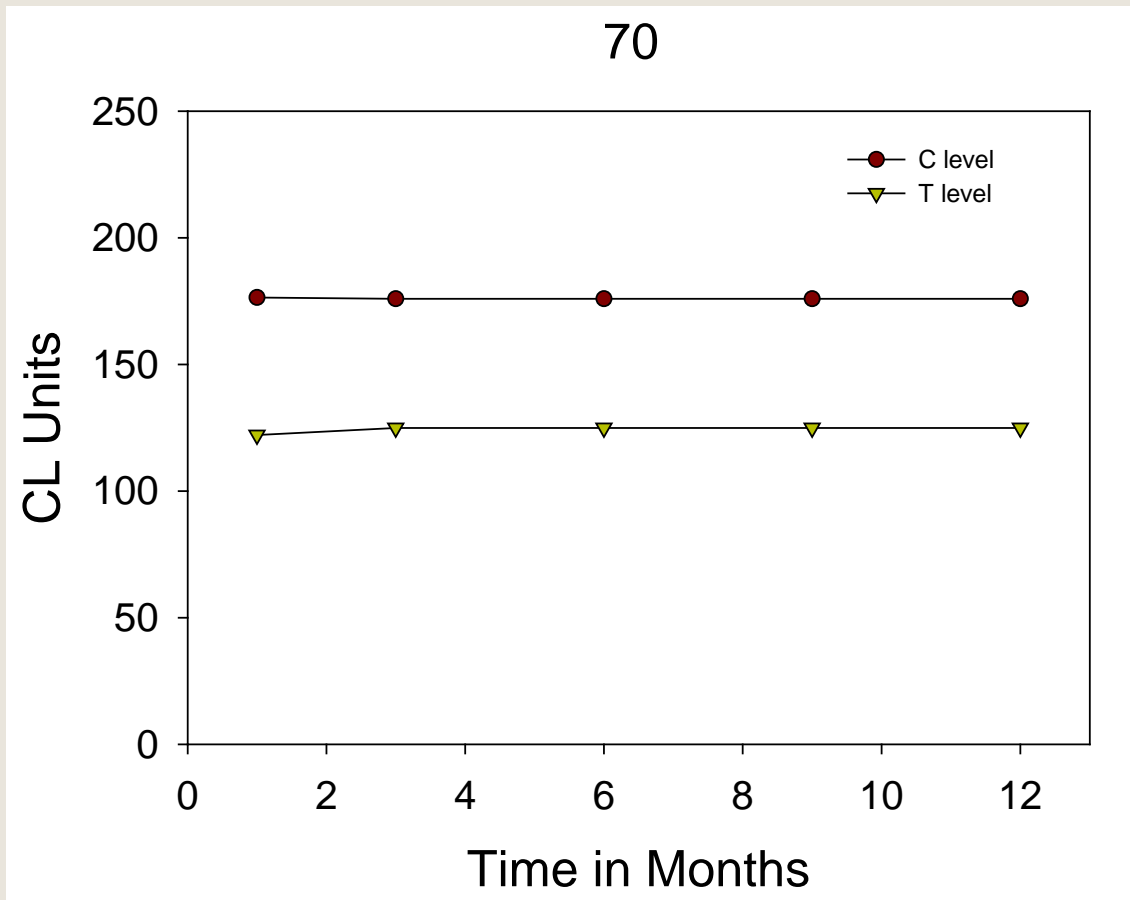
RESULTS

- Two subjects showed an increased dynamic range over time



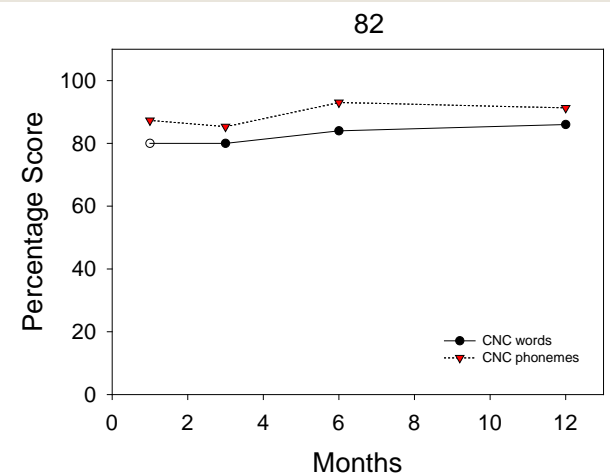
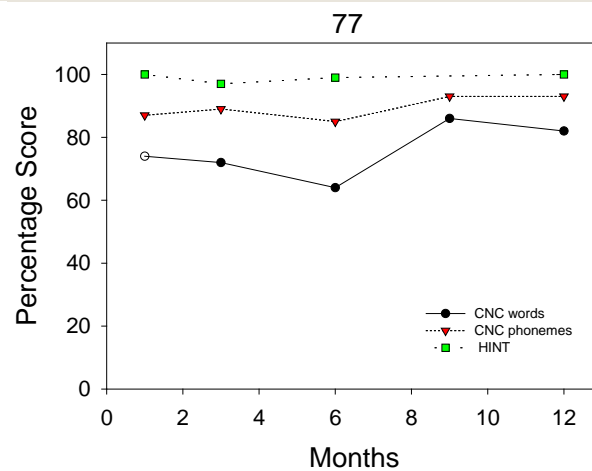
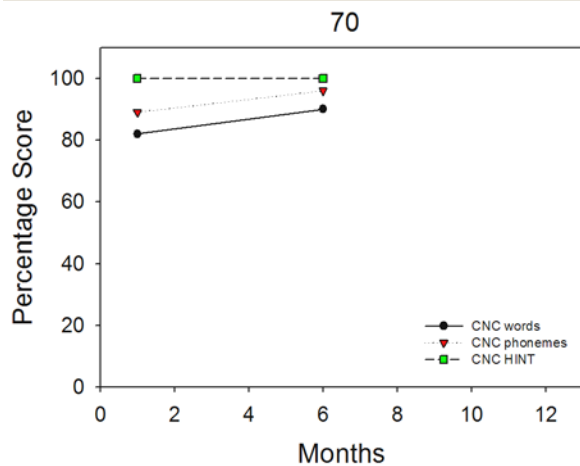
RESULTS

- One subject's dynamic range remained stable throughout the year



RESULTS: SPEECH

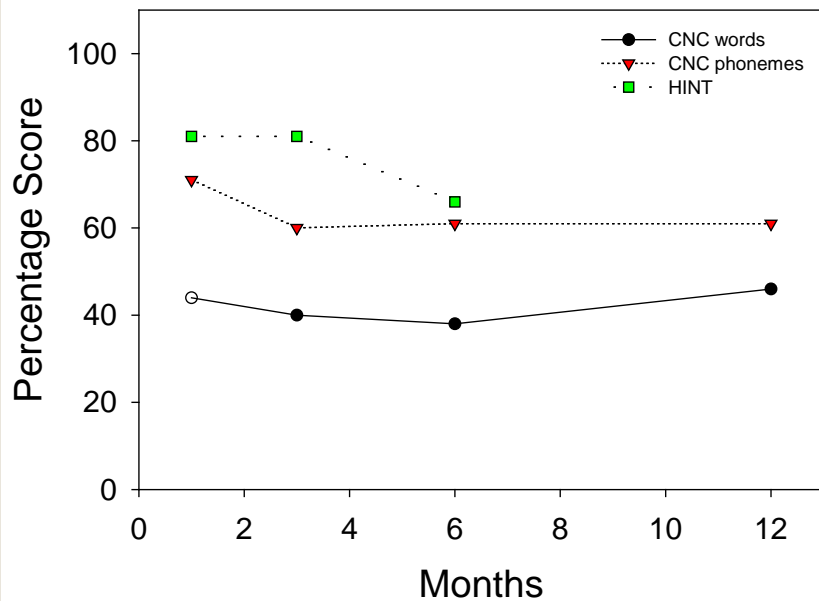
- Two subjects showed slight improvement on speech tasks
- Most subjects were limited by ceiling effects



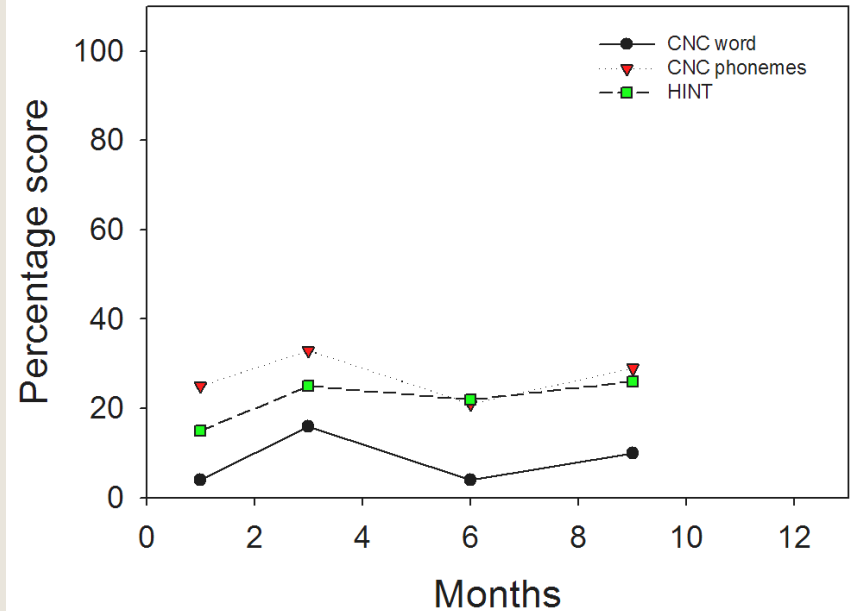
RESULTS- SPEECH

- Two subjects showed little or no improvement over time
- Overall: No relationship observed between speech performance and T and C levels

80

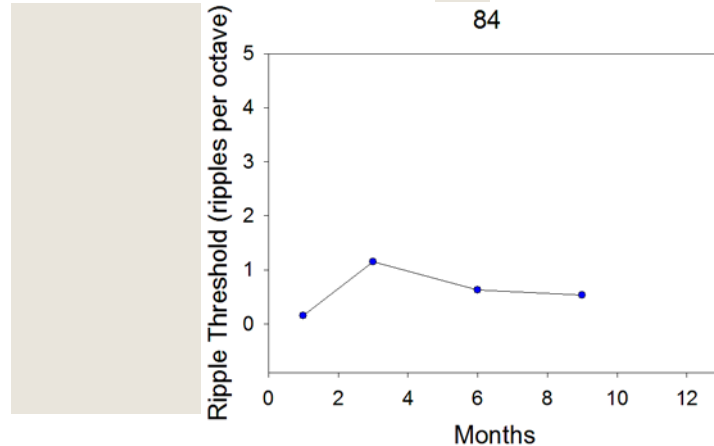
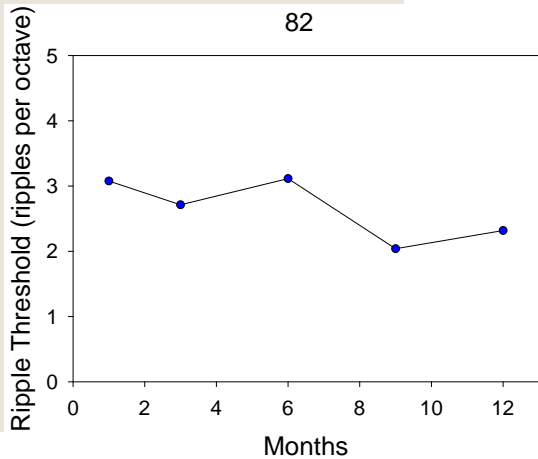
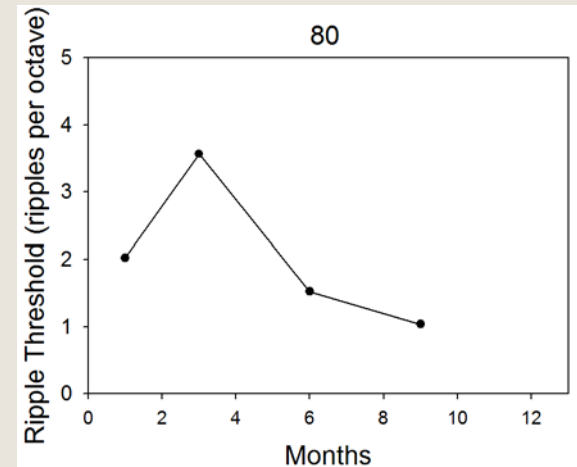
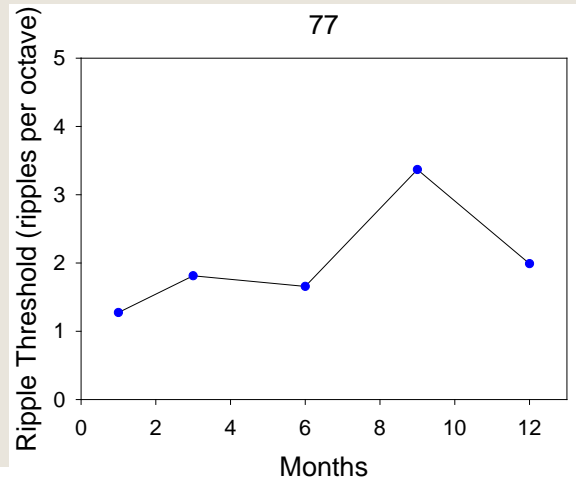
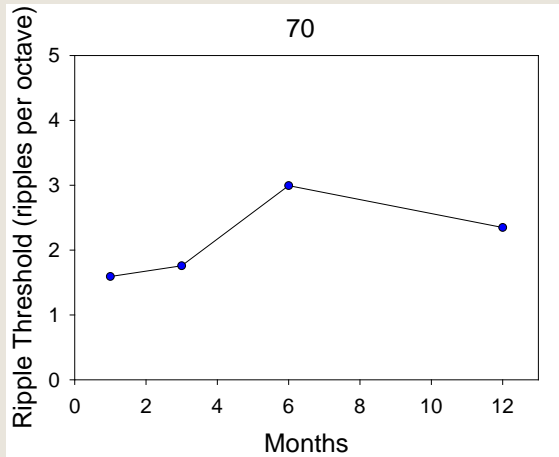


84



RESULTS: SPECTRAL RIPPLE

- Scores varied across and within subjects, with no predominant trend over time



CONCLUSIONS

- Is there a relationship between cochlear implant performance and T and C levels over time?
 - *In this study, no relationship was observed among T and C levels and subjects' performance and speech and spectral ripple discrimination tasks*
- Future research:
 - How do other variables of the device affect these performance measures?
 - Do children typically have different changes made to their levels? How do these changing levels affect their performance?

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