Patients with cerebellar degeneration (CD) are impaired in adapting speech to consistent auditory feedback perturbations, suggesting impaired feedforward control.

This impairment is observed when the perturbation is introduced abruptly or gradually.

In contrast, CD patients show an increased on-line compensatory response to randomly introduced F1 perturbations, a response dependent on feedback control.

Cerebellar degeneration selectively disrupts feedforward, but enhances feedback, speech motor control.

**Summary**

**PROCEDURE:**
- Manipulate first vowel formant (F1) in real time [1]
- Playback loud enough to mask original speech
- Create sensory error between expected and received auditory feedback

**PARTICIPANTS:**
- Patients with cerebellar degeneration (n = 19)
  - Speech mildly impaired: 2.25 (.79) on MOCA speech scale (0-8)
  - No other speech/hearing problems or neurological disorders
- Healthy matched controls (n = 14)
  - Age- and gender-matched
  - No speech/hearing problems

**Feedforward control**

Adaptive response

F1 perturbation was introduced gradually or abruptly. Some studies have shown cerebellar patients may retain the ability to adapt to gradual perturbations [2,3], though others have not [4,5]. Gradual was always tested first.

“Catch” trials were included in which auditory feedback was eliminated and masking noise was increased in volume:
- 20 catch trials randomly distributed during trials 60-120 of each block.
- Note that loud masking noise causes general increase in F1 [2]

CD patients show impaired adaptation to consistent F1 perturbations introduced abruptly.

**Feedback control**

Compensatory response

F1 was perturbed by 150 Hz (increase or decrease) on random subset of trials for the duration of the trial.
- Increased on 20 trials; decreased on 20 trials.
- No more than 3 consecutive trials with perturbations and same perturbation never repeated on consecutive trials

CD patients show greater within-trial compensation to unexpected perturbations.

**References**


Thanks to Giana Cirolia for help with data collection + analysis and Zarniah Agnew.