Introduction of advanced hearing instrument technology to children

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Hayley

- Congenital hearing loss, aided from 17 months, some deterioration in hearing levels from severe to profound
- Now 10 years old
- Attends mainstream school
- Wearing linear analogue hearing aids verified with aided thresholds
Audiogram for Hayley

Right:
- Frequency in Hz
- dB HL

Left:
- Frequency in Hz
Sound-field Aided Thresholds
Aided thresholds used to predict functional benefit of hearing aid fitting
What are the optimum aided thresholds?

Assumption

The lowest level of detection gives greatest audibility.
The greatest audibility will give the best access to speech.
(The more you can hear, the more you speech you can hear)
Hayley’s hearing aid amplification
Cochlear Hearing Loss

Benefit of amplification is limited by:

- Extent of hearing loss
- Recruitment
- Poor frequency resolution
- Poor timing encoding
- Possible dead regions
Simulation of these amplification characteristics
Change in hearing aid amplification is always cognitively challenging

- These hearing aids worn for years
- Used at maximum volume settings
- Struggling in school
- Bullying arising from social / communication misunderstandings
- Often tired, tends to be unwell

This amplification is unlikely to be using residual hearing to optimum
Change hearing aid to find best algorithm for Hayley

- Need to fit amplification to a prescription formula
- Fitted to DSL [i/o] targets with peak-clipping
- Initial speech discrimination testing worse with new hearing aid fitting (closed set testing)
- Hayley very unhappy, “too quiet”
- Encouraged to wear for 2 weeks
- “Happier with hearing aids”
- Swopped the hearing aids from right to left
Audiogram for Hayley
Loudness density of different prescription rationales
Two months to tolerate DSL prescription fitting

- Changed to output compression (SC) algorithm matching DSL targets
- Aids used for 2 weeks
- Tolerance improving
- Speech testing with SC algorithm
- Changed to WDRC and retested after lunch on same day
Video of speech testing
Results: Profound group, Closed set (p = 0.008) n=9
Profound group, Open set (NS) n=8

Presentation levels in dBA

Number correct

80 65 50

Profound group CJW score
Severe group, Open set (NS) n=8

Severe group CJW scores

Number correct

Presentation level

45 in qt 80 in qt 50 in ns

Severe group CJW scores

Number correct

Presentation level

45 in qt 80 in qt 50 in ns

PC WDRC SC
Conclusions

- Aided thresholds cannot be used to infer speech discrimination ability
- Need speech testing to assess speech recognition and discrimination
- Change in hearing aid algorithm is always challenging for wearer and they are unlikely to perceive benefit in function initially
- The use of WDRC can be beneficial to people with severe and profound hearing loss
We are only acquiring information on how to use signal processing best for young children.

It is crucial to have shared information on successes and failures, made possible by conferences like this one.

Thank you.