Cochlear implants and radio aids

University of Southampton Auditory Implant Service (USAIS)

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Effective fitting of radio aids with CI

Our workshop aims include:

• a review of the variety of systems and how they connect

• how to fit – matching and checking based on the protocols used at USAIS

• methods to evaluate the benefit

• resource implications and when to fit

• an opportunity for discussing and sharing good practice
Cochlear Implant Systems at USAIS

Cochlear implants can work well with radio aids.

We will
- describe our practice and experience of systems at USAIS
- demonstrate the CI and RA test procedure.
A leading question ...

- What is the purpose of balancing radio aids?

- To ensure that the level and quality of sound a user hears through the radio aid microphone matches what they hear through the microphone of the hearing instrument or the sound processor.
UK Quality Standards: July 2008, updated February 2017

http://www.ndcs.org.uk/professional_support/our_resources/education_resources.html#contentblock25
Every deaf child ...

- Has potential
  - Through technological advances and enhanced processing strategies the majority of children with hearing impairment have the potential to access all of the sounds of spoken language.

- Needs a sound start
  - A good listening experience right from the start, appropriate support and appropriate use of technology achieves better outcomes.

See McCracken et al. (2012), Ching (2015) and Yoshinaga-Itano & Wiggin (2016).
QS3 Ensure the desired advantage

- Level too High
  - Serious risk of distortion
  - A distraction
  - Danger of compression
QS3 Ensure the desired advantage

• Level too High
  – Serious risk of distortion
  – A distraction
  – Danger of compression

• Level too Low
  – Makes little difference to the user
  – A waste of resources and leads to disenchantment
  – Disadvantaged access to spoken information
Getting the level right is crucial

Why?

Because the dynamic range of hearing for cochlear implant users is markedly reduced compared to individuals with hearing within normal limits.
What is different with CI?

- We can’t listen to the whole system output via the processor - only a CI user can do this.
- However, we can monitor the input.
- We can:
  - use the relevant listening accessory to monitor the radio aid signal received by the sound processor
  - use the relevant hearing instrument test box lead to obtain the frequency response of the microphone of the sound processor and with the radio aid input.
Acoustic transparency QS8

- Most devices can be balanced in the test box using specific leads
How to create consistent comparative response curves of Cochlear Implant microphones

1. Cochlear Nucleus Freedom BTE - DCTEST2 Lead only.
2. Cochlear Nucleus 5 CP810 BTE - DCTEST3 Lead only.
3. Cochlear Nucleus 6 CP910 BTE - DCTEST3 Lead only.
4. Advanced Bionics Harmony - DCTEST4 lead and AB Harmony Listening Check. CI-5821.
5. Advanced Bionics Neptune - DCTEST4 lead and Neptune Connect AB: CI-5241-WHT (White)-BLK (Black).
6. Advanced Bionics Naida Q70 BTE - DCTEST4 lead and Naida Listening Check. CI-5823.
7. Med-EL Opus2 BTE - DCTEST4 lead and Microphone Test Device 02883, Mini Battery Pack (28cm lead) 08264, MBPMTD Connecting Cable 08082.
Acoustic transparency $\text{QS}^8$

- Most devices can be balanced in the test box using specific leads

- Some devices require extra equipment or have to be done through the manufacturer’s fitting software.

- Work by SOECIC (USAIS), Cochlear® and the UKFMWG led to an electroacoustic test protocol for cochlear implant sound processors and radio aids that provides the desired advantage (see previous QS and guidance).

  - also see Schafer et al. (2013)
Obtaining the curves.
Ready?
Processor on its own
Processor on its own
Processor and radio aid at default setting
Processor and radio aid at default setting
Processor and radio aid: new gain setting

![Graph showing coupler multi-curve with SPL (dB) on the y-axis and frequency on the x-axis. Tables showing leveled ear left settings for various conditions including COMP ANSI, SMTH LOG, N.R. 4X, and RMS OUT with values such as 85.96dB, 85.71dB, and 90.27dB.]
Evaluation
System evaluation QS7, 8, 10

“Measures of benefit must not only include objective measures, but also patient perception of benefit” Clark et al. (2016:4)

• Observation of behaviours and functional listening

• Real world questionnaires (Haigh 2016, Zanin & Rance 2016)

• Evaluate speech recognition in quiet

• Evaluate speech recognition in noise with and without the radio aid system
Speech perception in noise

~ 75 - 80 dB(A) at 15-20cm

speech 65dB(A) + variable noise

McCormick Automated Toy Discrimination test

Ousey et al. (1989), Palmer et al. (1991) Summerfield et al. (1994) and Lovett et al. (2013)
Resource Implications

- Timing
  - When to fit?
  - Radio Aid CHIP
<table>
<thead>
<tr>
<th>Dependent - Not yet ready for a Radio Aid system</th>
<th>Emerging Independence - almost ready for a Radio Aid system. Joint discussion- USAIS/local team</th>
<th>Developing Independence - ready to fit Radio Aid systems/newly fitted Radio Aid users with daily support</th>
<th>Established Independence - independent use of Radio Aid system/possible consideration of ear level receivers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manages CI equipment</td>
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<td>Manages CI equipment</td>
</tr>
<tr>
<td>□ Mapping is ongoing, or has not yet been consistent for 6m.</td>
<td>□ Has a consistent map of at least 6m</td>
<td>□ May be preparing to use different programmes for different listening conditions. Any different programmes need adult oversight.</td>
<td></td>
</tr>
<tr>
<td>□ Due to have a second side sequential implant.</td>
<td>□ Establishing use of sequential second side CI.</td>
<td>□ Able to change batteries with distant oversight. Takes responsibility for carrying spare batteries and remembers to 'top up' as needed.</td>
<td></td>
</tr>
<tr>
<td>□ Wears speech processor all waking hours and replaces the coil(s) when required. Starting to report when the batteries need replacing.</td>
<td>□ Very reliable in reporting flat batteries and starting to take some degree of responsibility over batteries (e.g. aware that they are in book bag).</td>
<td>□ Can place / replace speech processor(s) behind the ears without help. Switches on independently.</td>
<td></td>
</tr>
<tr>
<td>□ Takes speech processor(s) to an adult for help to put it / them on. Needs help to ensure speech processor(s) are securely behind the ear(s).</td>
<td>□ Tries to put on CI processors independently but may need some help.</td>
<td>□ Helps to store speech processors carefully when swimming or at the end of day.</td>
<td></td>
</tr>
</tbody>
</table>
Resource Implications

• Timing
  – When to fit?
  – Radio Aid CHIP
  – Processor settings and map stability

• Setting up and evaluation
  – Is the child ready to do a Toy Test?
Resource Implications

• Provision of suitable Radio Aid $QS_{11}$
  – what is being fitted?
  – are there any other radio aid users in the setting?
  – is there a particular frequency/channel needed?
  – is there a soundfield system being used? $QS_{12}$
What you can do locally

- Comprehensive radio aid checks on a regular basis
  - Checking of gain settings via test box
  - Ling sounds
  - Speech tests
- Regular
  - dialogue with user for their feedback
  - liaison with implant centre
In summary: plan, liaise, fit, match & check

UKFMWG  Quality Standards for the use of personal radio aids: Promoting easier listening for deaf children (NDCS 2017)

- Consider candidacy, ability and experience QS1, 2
- Liaise well QS9, 11
- Ensure that the sound level is appropriate for the child QS3
- Monitor and evaluate regularly QS4, 7, 8, 10, 12
- Keep up to date QS5, 6
Any questions?

Discussion points?
References


Text also available at: https://maryhareschool.org.uk/public/downloads/Azoer/LIFE_R_Article_for_BATOD.pdf
References


References


Thank you for coming.

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