Does amplification improve speech in noise perception and localisation accuracy of children with unilateral hearing loss?

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Clinical Motivation for Research

Congenital Unilateral Hearing Loss (UHL) is now identified at birth under Newborn Hearing Screening (NHSP).

Also identified later in childhood.

Children with UHL struggle in complex listening environments e.g. The classroom (Bess and Tharpe, 1984 and Dancer et al, 1995).

Speech in noise perception (SPIN) (Ruscetta et al, 2005) and Localisation (LOC) (Humes et al, 1980) accuracy is effected.

What is the most effective management and rehabilitation for children with UHL? (Sutton et al, 2012)
NHS Audit / Service Evaluation

Does the hearing aid (HA) actually improve SPIN perception and LOC?

Using objective and subjective measures

Null Hypotheses

1) There is no difference in LOC with or without the HA.

2) There is no difference in SPIN perception with or without the HA.
Participants

• 10 initially recruited. 1 cancelled and 1 technical error prevented testing.

• VARIABLES: age range 4 – 17 years / usage 2 months to 2 years / 4 Conductive hearing loss (CHL) 3 sensori neural hearing loss (SNHL) and 1 mixed hearing loss.
Objective Assessments

-2 Assessments: LOC and SPIN
-2 conditions: with HA and without (randomised)

Task 1: LOC

5 toys displayed on screens 15 degrees apart – ‘Hello, what’s this?’ Child matches image on touch screen to where they think the sound came from.

Completed by 7 children
LOC Results

Wilcoxon, $z = -2.37$ $p = 0.02$

- Non-parametric statistical tests. All reported at the 0.05 significance level.
- Significant decline in localisation accuracy with amplification, across the group.
- All of the children’s localisation accuracy was worse when in the aided condition.
Objective Task 2: SPIN

Closed set IHR - McCormick Automated Toy Discrimination Test (10 toy version) (Summerfield, 1994).

Diagram showing the setup for the SPIN task with speakers at various angles.
SPIN Results

- Huge variation in Spatial Release from Masking (SRM) change as a result of amplification.

- No significant difference between the aided and unaided scores to either the better or worse ear across the group.

- No relationship between time with hearing aids or level of hearing loss.
Subjective Assessments

- 2 Assessments: Speech, Spatial and Qualities of Hearing scale for parents of children with impaired hearing (SSQ-P) and a Unilateral Hearing Loss Questionnaire (UHL – Q)

- 2 conditions: pre and post amplification

Task 1: SSQ – P  

*(Galvin et al, 2007)*

- Parents only
- Retrospective
- 3 Sub sections: speech; spatial and quality of hearing

5. You are talking with your child. There is a continuous background noise, such as a fan or running water. Can your child follow what you say?

<table>
<thead>
<tr>
<th>Not at all</th>
<th>Perfectly</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>10</td>
</tr>
</tbody>
</table>

Minimum | Maximum
--- | ---
0 | 10

[I] I do not know  [ ] This situation does not happen for my child
SSQ – P Results

Close to sig. dif. on pre HA score between children with R or L HL (Mann-Whitney, Z = -1.94, p=0.05).

Sig. dif. Between pre and post HA scores in right HL group (Z = -2.02, p = 0.043 but not in those with left HL (Wilcoxon, Z= -1.60, p = 0.11).

Total: Wilcoxon, z= -2.830, p = 0.017
Speech: Wilcoxon, z= -2.37, p = 0.02
Spatial: Wilcoxon, z= -2.20, p = 0.028
Qualities: Wilcoxon, z= -1.820, p = 0.069
Subjective Task 2: UHL – Q

- Child and parent sections
- Pre and post HA fitting
- E.g.s

Parent Question:
Your child’s ability to accurately localise a sound source

<table>
<thead>
<tr>
<th>BEFORE Hearing Aid</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td>WITH Hearing Aid</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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</tbody>
</table>

Child Question: being able to tell where sound is coming from

<table>
<thead>
<tr>
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<th>3</th>
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<tr>
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</tr>
</tbody>
</table>
UHL – Q Results

• All parents record improvement with amplification

• 6/8 children report improvement with amplification

• Parents perception did not always match the child’s.

• Sig. dif. In pre and post child scores (Wilcoxon, $z = -2.207$, $p = 0.027$).

• Sig dif. In pre and post parent scores (Wilcoxon, $(z = -2.527, p = 0.012)$)
Conclusions

• Subjective Benefit but no Objective Benefit –WHY?

• More participants needed!

Thoughts for clinical practice…

• Consider the hearing loss, not just that it is unilateral.

• Consider the Hearing Aid (Johnstone et al, 2010 a and b, Van de Boggaert, 2011).

• Auditory Training (Irving and Moore, 2011).

• Counselling
With Thanks to

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- Staff at the RNTNE, Nuffield Centre
- Project Supervisor: Dr Deborah Vickers
Thank you

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References


Images

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