Phonological Awareness and Alphabet Knowledge Training for Preschool Children with Cochlear Implants

Krystal L. Werfel
University of South Carolina

W. Michael Douglas and Leigh Ackal
Mama Lere Hearing School,
Vanderbilt Bill Wilkerson Center
Phonological Awareness in Children with Cochlear Implants

As shown in Table 3, the three spoken language variables were strongly correlated with one another within the CI group. To avoid multicollinearity and to limit the number of variables used in analyses with our small sample, we calculated a single language composite score for each child. For all but one child, this score was the mean of the standard scores from the PLS-4 Auditory Comprehension subscale, the PLS-4 Expressive Communication subscale, and the PPVT-4. For the one child who did not have a PPVT-4 score, we calculated the language composite by averaging his scores from the two subscales of the PLS-4.

We then calculated correlations between age at CI and length of CI experience with phonological awareness and print knowledge. No significant correlations were found ($r$'s = $-0.02$ to $0.27$, $p$s $> 0.05$).

We used multiple linear regression analyses to examine the contributions of the related skills to variability in the phonological awareness and print knowledge of the CI group. We calculated semi-partial correlation coefficients to determine the unique contributions of each individual predictor variable (see Table 4).

For the first regression, TOPEL Phonological Awareness was entered as the criterion variable, and the language composite, speech production, and speech perception variables were entered simultaneously as predictors. This model was significant, $F(3, 20) = 3.43$, $p = 0.037$, with the predictor variables accounting for 34% of the variance in the CI group's phonological awareness abilities. None of the predictor variables contributed unique variance to phonological awareness after accounting for the variance that was shared with the other predictors.

As another regression was conducted with TOPEL Print Knowledge entered as the criterion variable. Again, the language composite, speech production, and speech perception variables were entered simultaneously as predictors. Although language and speech variables correlated significantly with TOPEL scores on their own, this model combining all three variables was not significant, $F(3, 20) = 2.00$, $p = 0.146$.

Discussion

Phonological awareness and print knowledge are strongly predictive of later reading abilities, and there are empirical and theoretical reasons to expect preschool-age children with CIs to be significantly delayed in one or both of these early literacy domains. Previous research has examined these domains of literacy primarily with school-age children with CIs, many of whom received their implants relatively late or utilized

Figure 1. Individual performance of subjects in each group on the TOPEL Phonological Awareness and Print Knowledge subtests (Lonigan et al., 2007). The open symbols indicate the mean for each group. SS = standard score.

Table 3. Correlations among variables for the CI group.

<table>
<thead>
<tr>
<th>Variable 1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Phonological awareness</td>
<td>—</td>
<td>0.14</td>
<td>0.53**</td>
<td>0.52**</td>
<td>0.46*</td>
<td>0.44*</td>
</tr>
<tr>
<td>Print knowledge</td>
<td>—</td>
<td>—</td>
<td>0.33</td>
<td>0.50*</td>
<td>0.47*</td>
<td>0.46*</td>
</tr>
<tr>
<td>Language comprehension</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.86**</td>
<td>0.85**</td>
<td>0.72**</td>
</tr>
<tr>
<td>Language expression</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.89**</td>
<td>0.78**</td>
</tr>
<tr>
<td>Receptive vocabulary</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>0.75**</td>
</tr>
<tr>
<td>Speech production</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Speech perception</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

Spearman’s rho is reported for the correlations between speech perception and the other variables.

* $p < 0.05$. ** $p < 0.01$.

(Ambrose, Fey, & Eisenberg, 2012)
Phonological Awareness Training

(m)

(d)

(b)

(Werfel & Schuele, 2014)
Participants

• 9 preK children with cochlear implants
  – 6 bilateral, 3 bimodal

• Group Means
  – Total Language: 79.55
  – Expressive Vocabulary: 94.56
  – Receptive Vocabulary: 92.00
  – Nonverbal IQ: 91.67
Intervention

• 5-minute AK lesson
  – 4 days per week
  – “this is a ‘b’ and ‘b’ says /b/”

• 10-minute PA lesson
  – 4 days per week
  – adapted from IPA Program (Schuele & Dayton, 2004)
  – followed developmental progression of PA
  – repetition of lessons based on teacher judgment
  – introduced continuants before obstruents
Results: Alphabet Knowledge

Number Correct

Uppercase Letter Names

Pre
Post
Results: Phonological Awareness

[Diagram showing a bar chart for Beginning Sound Awareness with 'Pre' and 'Post' data points. The 'Post' data shows a significant increase indicated by an asterisk (*).]
Conclusion

• Small-group, classroom-based intervention led to significant growth across the 4-year-old prekindergarten year in targeted skills.
  – effective in as little as 15 minutes a day, 4 days a week