Early Speech Sound Development in Children with Lateralization Errors: Preliminary Data

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Pennsylvania Speech-Language Hearing Convention
April 9, 2016

Outline

• What we know about lateralization errors
• Study
  • Purpose
  • Methods
  • Results
  • Implications
• Questions and comments

What do we know about lateralization errors?

• Lateral lisp
  • Tongue pressures vary; generally high midline pressure on palate
  • Air escapes over sides of tongue
  • Possible effect on swallow patterns (McGlone & Proffit, 1973)
• Affect sibilant sounds /s, z, zh, sh, ch, dg/
• Not uncommon disorder (13.3% preschoolers) (McLeod, Harrison, McAllister, McCormack, 2013)
• Do not spontaneously or self-correct with age (Wilcox, Daniloff, & Ali, 1984)
• Listener perception (Silverman, 1976; Verissimo, Van Borsel, Pereira, 2012)
• Treat early (Smit, Hand, Freilinger, Bernthal, & Bird, 1990)
  • Electropalatography (McAuliffe & Cornwell, 2008)
  • Extended traditional treatment (Hickey, 1992)

Research Questions

• For children later diagnosed with lateralization errors:
  1. Is their volubility similar to children with typical speech sound development?
     Hypothesis: Volubility lower
  2. Do they develop consonants at the same rate as children with typical speech sound development?
     Hypothesis: Slower rate
  3. Is their development of syllable structure similar to children with typical speech sound development?
     Hypothesis: Slower rate

Why do they occur? (McLeod, Daniloff, & All, 1984)

• Least likely: speech discrimination deficits
• Oral sensory deficits
• Neuromuscular deficits or abnormal motor skill
  • Inability to control lateral margins of tongue (Juhasz, Hodge, & Ohberg, 2005)
  • Electropalatography useful (Juhasz & Hodge, 2005)
  • May be learned (Maggio, C. C. Crosby, & Adams, 1995)
• Speech sound disorders, in general, appear genetic
  • No data on lateralization errors
• Large gap in literature

Purpose: to compare early speech development of children later diagnosed with lateral lisps to speech development of children with typical speech sound development

I have relevant financial or non-financial relationships to disclose.
Method (Capece and Overby, 2012; Overby and Caspari, 2015; Wright and Overby, 2011)

- Participants
  - Two sisters lateralization errors
  - Brother with typically developing speech
  - Four girls with typically developing speech

Participant Descriptive Data

<table>
<thead>
<tr>
<th>Participant</th>
<th>Gender</th>
<th>Age</th>
<th>PPVT-4</th>
<th>OWLS-II</th>
<th>DEAP</th>
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<tbody>
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<td>L6</td>
<td>F</td>
<td>8.8</td>
<td>129</td>
<td>109</td>
<td>123</td>
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<tr>
<td>L7</td>
<td>F</td>
<td>6.3</td>
<td>116</td>
<td>111</td>
<td>106</td>
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<tr>
<td>Br11</td>
<td>M</td>
<td>3.11</td>
<td>94</td>
<td>112</td>
<td>107</td>
</tr>
<tr>
<td>TD1</td>
<td>F</td>
<td>3.8</td>
<td>113</td>
<td>114</td>
<td>116</td>
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<tr>
<td>TD2</td>
<td>F</td>
<td>5.2</td>
<td>125</td>
<td>132</td>
<td>121</td>
</tr>
<tr>
<td>TD3</td>
<td>F</td>
<td>5.11</td>
<td>111</td>
<td>98</td>
<td>100</td>
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</table>

Listening Oral Expression Inconsistency Articulation Phonology

<table>
<thead>
<tr>
<th>Listening</th>
<th>Oral Expression</th>
<th>Inconsistency</th>
<th>Articulation</th>
<th>Phonology</th>
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<td>100</td>
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</table>

Methods

- Coded home videos
- Vegetative sounds
- Fixed signals
- Protophones
- Resonant productions ("transcribable")
  - Resonant vowels & consonants, canonical babbling, true words

Participant Minutes video

<table>
<thead>
<tr>
<th>Participant</th>
<th>Minutes video</th>
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<tbody>
<tr>
<td>L6</td>
<td>186.8</td>
</tr>
<tr>
<td>L7</td>
<td>96.1</td>
</tr>
<tr>
<td>Br11</td>
<td>69.6</td>
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<tr>
<td>TD1</td>
<td>15.2</td>
</tr>
<tr>
<td>TD2</td>
<td>26.5</td>
</tr>
<tr>
<td>TD3</td>
<td>28.7</td>
</tr>
<tr>
<td>TD4</td>
<td>22.6</td>
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</tbody>
</table>

Lateralization total minutes = 284.9

Typically developing brother minutes = 69.9

Results: Speech Sound Development

<table>
<thead>
<tr>
<th>Participant</th>
<th>Volubility/minute</th>
<th>Volubility resonant utterances/minute</th>
<th>Volubility nonresonant utterances/minute</th>
<th># Diff consonants/minute</th>
<th># Resonant consonants/minute</th>
</tr>
</thead>
<tbody>
<tr>
<td>L6</td>
<td>8.00</td>
<td>2.71</td>
<td>5.29</td>
<td>.44</td>
<td>4.04</td>
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<tr>
<td>L7</td>
<td>9.52</td>
<td>2.84</td>
<td>6.78</td>
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<td>TD1</td>
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<td>4.48</td>
<td>4.54</td>
<td>.36</td>
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<tr>
<td>TD2</td>
<td>9.98</td>
<td>6.69</td>
<td>3.29</td>
<td>1.36</td>
<td>18.07</td>
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<tr>
<td>TD3</td>
<td>17.82</td>
<td>13.33</td>
<td>4.49</td>
<td>2.37</td>
<td>17.23</td>
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<td>TD4</td>
<td>3.28</td>
<td>1.76</td>
<td>1.51</td>
<td>.38</td>
<td>4.29</td>
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<tr>
<td>TD F Mean</td>
<td>10.03</td>
<td>6.57</td>
<td>3.46</td>
<td>1.24</td>
<td>11.51</td>
</tr>
</tbody>
</table>

Results: Statistical Analysis

- Bonferroni correction for Type 1 error
- Divide two tailed p value in half to test 1-tail directional hypothesis
- Mann-Whitney U exact test

Results: What Was Different

- Sibilants emerged later:
  - L6: 21 months
  - L7: no evidence by 24 months Mean = 21+ months
  - TD11 (brother): 24 months

- TD1: 17 months
- TD2: 24 months
- TD3: 19 months
- TD4: 20 months
Table 1: Syllable Structure Development

<table>
<thead>
<tr>
<th>Type</th>
<th>V</th>
<th>CV</th>
<th>VC</th>
<th>CVC</th>
<th>CVVC</th>
<th>VVVC</th>
<th>Other</th>
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</thead>
<tbody>
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<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
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<tr>
<td>TD</td>
<td>.50</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
<td>.00</td>
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<tr>
<td>Lateral lisp 7-12 months</td>
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<td>.28</td>
<td>.05</td>
<td>.03</td>
<td>.13</td>
<td>.04</td>
<td>.37</td>
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<tr>
<td>TD</td>
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<td>.70</td>
<td>.04</td>
<td>.25</td>
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<td>.04</td>
<td>.79</td>
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<tr>
<td>Lateral lisp 13-18 months</td>
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<td>.55</td>
<td>.09</td>
<td>.09</td>
<td>.18</td>
<td>.00</td>
<td>.71</td>
</tr>
<tr>
<td>TD</td>
<td>.81</td>
<td>1.34</td>
<td>.26</td>
<td>.14</td>
<td>.34</td>
<td>.00</td>
<td>.83</td>
</tr>
<tr>
<td>Lateral lisp 19-24 months</td>
<td>.81</td>
<td>1.48</td>
<td>.13</td>
<td>1.21</td>
<td>1.56</td>
<td>.17</td>
<td>1.13</td>
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<tr>
<td>TD</td>
<td>.87</td>
<td>2.03</td>
<td>2.21</td>
<td>2.71</td>
<td>1.28</td>
<td>2.20</td>
<td>3.03</td>
</tr>
</tbody>
</table>

Results: Syllable Structure Development

What Was Different

- Slower development in frequency of syllable structures, not in diversity of shapes

Implications

- Lateralization errors result from abnormal motor skills
- Differences appear during early development
- Affect rate of global development of speech sounds and syllable shapes
- Not seem to affect the diversity of consonants or syllable shapes
- Evidence suggests:
  - Need for early intervention
  - Difference is only slow rate so may be difficult to identify until sibilant production begins

Limitations

- Sample size
  - Need to account for variability in speech sound development
- Data dependent on single family
- Gaps in data
  - Analyzed volubility only by minute of video
  - Need percentage of time vocalized
  - Utterances vary in length and so percentage of time could be different could be different for two children even though utterance rate/minute is the same

Questions and Comments

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References

References