Respiratory sinus arrhythmia: During listening and speaking of preschool-age children who stutter

Robin M. Jones, Anthony P. Buhr, Edward G. Conture, Carl B. Frankel, & Tedra A. Walden – Vanderbilt University

ABSTRACT

Preschool-age CWS (n = 16) and CWNS (n = 15) listened to and viewed emotionally arousing, G-rated film clips, and completed narrative speech tasks during which their heart rates were monitored. Inter-beat-interval (IBI) series were created from raw electrocardiogram (ECG) waveforms, and respiratory sinus arrhythmia (RSA) was calculated. Results indicated that CWS exhibited marginally significantly lower RSA than CWNS. In addition, CWS displayed a significant decrease of RSA from baseline to speaking, where as CWNS displayed a significant increase of RSA from baseline to speaking. Findings were taken to suggest that CWS may experience challenges physiologically regulating emotion when talking, a difficulty that may contribute to their inability to establish normal fluency.

METHOD

Participants

Sixteen preschool-age CWS (13 males) and 15 preschool-age CWNS (8 males) participated. CWS produced 3 or more SLDs per 100 words and scored 11 or higher on SSI-3. CWNS produced 2 or fewer SLDs per 100 words and scored 10 or lower on SSI-3.

Procedure

Participants were seated in front of a computer monitor. Ag/AgCl electrodes were placed at the superior jugular notch of the rib cage and below the lower rib on the left side of the body. Participants listened to and viewed (referred to as “listening”) a series of film clips from age-appropriate movies. A Biopac MP150 system (Biopac Systems, Inc.) monitored electrocardiographic (ECG) signals, which were digitized at 1250 Hz.

RESULTS

From ECG…. Electrocardiogram (ECG) converted to interval series for respiratory sinus arrhythmia (RSA).

Estimated Marginal Means

<table>
<thead>
<tr>
<th>Condition</th>
<th>Overall RSA</th>
<th>RSA during Listening</th>
<th>RSA during Speaking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-baseline</td>
<td>5.752</td>
<td>5.752</td>
<td>5.752</td>
</tr>
<tr>
<td>Negative</td>
<td>5.626</td>
<td>5.626</td>
<td>5.626</td>
</tr>
<tr>
<td>Positive</td>
<td>6.065</td>
<td>6.065</td>
<td>6.065</td>
</tr>
</tbody>
</table>

Main Finding #1: Overall RSA

Main Finding #2: RSA during Listening

Main Finding #3: RSA during Speaking

Main Finding #4: RSA change from baseline to speaking decreased for CWS but increased for CWNS, suggesting that CWS’s vagal activity is less than facilitative of speech.

CONCLUSION

The present study explored RSA differences between preschool-age CWS and CWNS during listening and speaking tasks. RSA is typically used to measure parasympathetic regulation of the heart and responsiveness to environmental challenge. Using RSA change from baseline as a measure of adaptive responding to environmental situations, it appears that CWS, compared to CWNS, respond physiologically differently when required to speak. These apparent differences were taken to suggest that CWS may experience challenges in physiologically regulating emotion when talking, a difficulty that may contribute to their inability to establish normal fluency.

REFERENCES

Biopac Systems, Inc. MP150 System: Guila, CA.

This work was supported in part by an NICHD training grant (T35 CH00021), NICHD Grant P30HD0502, NIH Grants R01 DC000521-13, R01 DC000523-14, and R01 DC004770-01A2, and a Vanderbilt University Discovery Grant.