Aerodynamic Profiles of Females with MTD

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A perceived voice problem in the absence of any known underlying structural or neurologic abnormalities
Awan & Roy, 2009; Roy, 2003; Verdolini, Bryar, & Kassell, 2007

Synonyms include “hyperfunctional voice disorder,” “functional dysphonia,” and “muscle-misuse voice disorder”
Hillman, Holmberg, Perkell, Walsh, & Vaughan, 1989; Morrison, 1997; M. Morrison & L. Rammage, 1993; Roy, 2007

Likely due to multiple mechanisms.....

Primary MTD

Hillman, Holmberg, Perkell, Walsh, & Vaughan, 1989; Morrison, 1997; M. Morrison & L. Rammage, 1993; Roy, 2007

Abnormal chest wall activity
Hočevar-Boltežar et al., 1999; Rubin, Macdonald, & Blake, 2010

Paradoxical breathing
T. J. Hixon & Hoit, 2005; T. J. Hixon et al., 1976

Low lung volume requiring greater expiratory muscle activation (vs passive recoil)
T. J. Hixon & Hoit, 2005; T. J. Hixon, Mead, & Goldman, 1976

“breath-holding”
Shires, 1993

Respiratory-phonatory coordination

Airflow

<table>
<thead>
<tr>
<th>Est-P sub</th>
<th>Low</th>
<th>Normal</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Normal</td>
<td>n=2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>n=1</td>
<td>n=1</td>
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Small sample sizes
- Threat to external validity
- Generalizability
- Subjective clinical observations
- Lack of objective testing
- Unable to replicate
- Subject selection
- Mixed pools (+/- interventions)

**Gaps**

**Research Questions**
1. Do aerodynamic profiles of females with MTD differ from those of healthy speakers?
2. Can different patterns of aerodynamic profiles be identified for women with MTD?

**Current Study**
- Patient records 2005-2008 (single data collection system- Aerophone II (KayPENTAX, NJ))
- Females ≥ 18 y/o
- Initial visit dx MTD

**Current Study**
- 96 subjects
- Mean estimated subglottal pressure (est-P_{sub}) at MCP & loudness levels
- Mean translaryngeal airflow (airflow) at MCP & loudness levels
- Aero Methods: Hillman et. al., 1989; Holmberg et.al., 1988; Smitheran & Hixon, 1981
- Comparison group: Holmberg et al., 1988

<table>
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<tr>
<th>Mean P_{sub}</th>
<th>SD</th>
<th>Mean airflow</th>
<th>SD</th>
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<tbody>
<tr>
<td>6.3 cmH\textsubscript{2}O</td>
<td>1.4 cmH\textsubscript{2}O</td>
<td>190 mL/sec</td>
<td>70 mL/sec</td>
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Do aerodynamic profiles of females with MTD differ from healthy speakers? YES.
- 1-sample t-test
- Mean est-Psub significantly different between groups (p<.001).
- Mean average airflow significantly different between groups (p<.003).

Can different patterns of aerodynamic profiles be identified for women with MTD? YES.
- TwoStep Cluster Analysis
- 5 distinct groups identified

### Data Analysis & Results

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<td>32.3% (n=29)</td>
<td>11.1% (n=10)</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>17.8% (n=16)</td>
<td>20.0% (n=18)</td>
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First study to analyze large number of aerodynamic profiles of females with MTD
Aerodynamic profiles different between subjects with MTD vs healthy controls
- Detected 3 profiles previously identified (Hillman et al., 1989) + 2 additional:
  - Normal airflow, normal pressure
    - Task does not represent natural speech, does not represent disordered voice; other processes that cause MTD symptoms not captured by aerodynamic analyses
  - Low airflow, normal pressure
    - Increase in respiratory checking action
    - Holding back airflow
    - i.e. "breath-holding" (Stone, 1993)

Discussion
### Discussion

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### Limitations

- Retrospective
- Lack of some experimental controls - multiple clinicians collecting data, multiple years
- Loudness - may cause variability
- Task is not “conversational speech”

### Relationship between psychological traits and voice disorders

- NA/anxiety $\rightarrow$ MTD (Dietrich, et al., 2008; Andrews, et al., 1987; Kinz, et al., 1988; Roy et al., 2005; van Mersbergen, et al., 2008; Willinger et al., 2005)
- Relationship between respiration and psychological traits
  - Hyperventilation $\rightarrow$ hypocapnia (decrease CO2)

### Theoretical explorations

**WHY?**

It doesn’t add up…….
Theoretical explorations

- Glottal aperture increases/decreases as a function of blood-gas concentration
- Hypercapnia → decreased resistance
- Hypocapnia → increased resistance


Future directions

- Respiratory-laryngeal interactions in varying blood-gas conditions.
- Respiratory-laryngeal interaction in individuals with psychological disorders.

Theoretical explorations

- Perhaps changing laryngeal resistance - the ratio of subglottal pressure to airflow - in response to changing levels of carbon dioxide, is one explanation for the aerodynamic profile variability seen in individuals with MTD.
- Respiratory larynx - modulating airflow for respiratory blood-gas homeostasis
- Phonatory larynx - maintaining appropriate resistance for communication

Thank you!