Speaking and Swallowing with noninvasive positive pressure ventilation (NPPV)

AGENDA

- Overview of NPPV
- Speaking with NPPV
- Swallowing and coughing with NPPV
- Role of the speech-language pathologist
- Questions and wrap up

NONINVASIVE POSITIVE PRESSURE VENTILATION (NPPV)

Noninvasive versus Invasive

...Noninvasive ventilation (NIV) may include other forms of ventilation...

NPPV Interfaces

Face mask  Nose mask

Mouthpiece  Nasal pillows

Advantages of NPPV (over IPPV)

- Avoid risks associated with intubation and tracheostomy
  (Theerakittikul et al., 2010; Person 2009)

- Improved swallowing and breathing-swallowing coordination
  (Garguilo et al., 2016; Terzi et al., 2014)

- Reduced risk for pneumonia (Carron et al., 2013)
Complications of NPPV
- Aerophagia / gastric insufflation
- Nasal / oral dryness
- Nasal congestion
- Facial pain from interface

Contraindications of NPPV
- Severe hypoxemia
- Anatomic abnormalities that interfere with airflow delivery
- High aspiration risk
- Inability to cooperate
- Recent airway or gastrointestinal surgery

Speaking with NPPV
- “Better speech”

OUR STUDY
- 12 participants: 10 men with muscular dystrophy, 2 women (1 with post-polio and 1 with SCI)
- Ages: 22-68; M34.42; SD 13.98
- Daytime: mouthpiece NPPV
- Nighttime: nasal BPAP (except 1, who used CPAP)
- NPPV use: 1 to 19 years

Qualitative Study
Purpose: To describe the experiences of speaking & swallowing with two forms of noninvasive positive pressure ventilation (NPPV) in individuals with muscular dystrophy:
- Mouthpiece NPPV
- Nasal Bilevel Positive Airway Pressure (BPAP)

Description | Interface
--- | ---
Mouthpiece NPPV | Mouthpiece
- Volume targeted
- Triggers:
  - By user (“assisted breaths”)
  - Timed delivery (“controlled breaths”).

Nasal Bilevel Positive Airway Pressure (BPAP) | Nasal mask
- Pressure targeted – alternates between higher (inspiratory) and lower (expiratory) pressures
- Triggers:
  - By user (“pressure support”)
  - Timed delivery (“pressure control”).

Britton et al. (2016)
Purpose of Study

To describe the experiences of speaking and swallowing with mouthpiece NPPV and nasal bilevel positive airway pressure (BPAP)

STUDY DESIGN

- Phenomenology: To describe the “lived experience” of a phenomenon
- The experience of swallowing and speech with 2 forms of NPPV

Data Collection and Analysis

- Semi-structured in-depth (~1-2 hrs) interviews focused on speaking and swallowing with NPPV
- Audio / video recorded, transcribed, and verified
- Phenomenological qualitative research methods were used to code (Dedoose.com) and develop themes

Participant-report:
Communication Participation Item Bank (CPIB) (Baylor et al., 2013)

<table>
<thead>
<tr>
<th>Speaking with</th>
<th>Mean</th>
<th>SD</th>
<th>Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>M-NPPV</td>
<td>55.73</td>
<td>5.36</td>
<td>49 - 64.2</td>
</tr>
<tr>
<td>BPAP</td>
<td>51.65</td>
<td>12.58</td>
<td>32.4 - 71</td>
</tr>
</tbody>
</table>

Possible range (highest to lowest): 71 to 24.2

Three Primary Themes

1. M-NPPV aids speech
   - ↑ loudness
   - ↑ utterance duration
   - ↑ intelligibility
   - ↑ speaking endurance

2. M-NPPV interferes with the flow of speech

3. BPAP interferes with speech
"Thankfully with this ventilator I can inflate my lungs more and I can talk louder. Without it … I talk kind of quiet."

"It helps me speak louder with more volume."

"When I take a puff, I can talk a lot."

"It makes my voice stronger and more clear…. Makes my voice so I can talk louder (for) longer periods of time, say longer sentences, without having to take a breath."

"I have to take a breath in the middle of a conversation and there's like a slight pause, or where I sort of sometimes have to look away a little bit to… you know when I turn my head to it… Cause, it just, you know, interferes with the pace and the flow of the conversation.""

"It's a little hard to talk sometimes with the air tube in the mouth."

"You know, everyone is talking fast, it's hard to hold it (mouthpiece) out there and say something fast."

"Sometimes the (speech recognition) software will hear my ventilator going off and try to find a word for that sound."
BPAP INTERFERES WITH SPEECH

"I've got to time my words to the inhalation."

"It's not very easy.... I can manage to communicate a little, but it's you can tell because you’re not wanting the air to go down and leak out your mouth while you're doing that."

"It's almost like talking with... someone plugging your nose."

"I don't have the same control, and I can't make it breathstack."

VIDEO: BPAP: Interference with speech

From the perspective of the NPPV user:

- Mouthpiece NPPV may aid speech loudness, utterance duration, intelligibility and speaking endurance; however, its use also interferes with the flow of speech.
- Nasal BPAP interferes with speech, owing to muffled speech, nasal resonance, mask discomfort, and reduced coordination of breathing with speaking.

Speaking with NPPV

Conclusions

Would speech be even better with mouthpiece NPPV if users actually used the ventilator when speaking?

SWALLOWING & COUGHING WITH NPPV

OUR STUDY

- 10 men with muscular dystrophy (MD) – recruited through the UWMC Pulmonary Medicine Clinic
- Age: Average 29.3 SD 7.1 Range 22-42
- Duchenne MD (n=9); Becker's MD (n=1)
- All used M-NPPV (daytime)
- 9/10 use BPAP (nighttime); 1 uses CPAP (nighttime)
- Duration of NPPV use (years): Average 8 Range 1-19

Participant-report:

Eating Assessment Tool (EAT-10) (Belafsky et al., 2008)

Mean 11.3 SD 6.8 Range 3-22

<table>
<thead>
<tr>
<th>Eating Assessment Tool</th>
<th>Mean (SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lose Weight</td>
<td>1.2 (1.62)</td>
</tr>
<tr>
<td>Interference with eating out</td>
<td>1.0 (1.33)</td>
</tr>
<tr>
<td>Extra effort liquids</td>
<td>0.8 (0.65)</td>
</tr>
<tr>
<td>Extra effort solid foods</td>
<td>1.5 (0.88)</td>
</tr>
<tr>
<td>Extra effort pills</td>
<td>2.0 (1.43)</td>
</tr>
<tr>
<td>Pain with swallowing</td>
<td>9.0 (0.0)</td>
</tr>
<tr>
<td>Measure of eating affected</td>
<td>0.7 (0.95)</td>
</tr>
<tr>
<td>Food sticks in throat</td>
<td>1.7 (1.14)</td>
</tr>
<tr>
<td>Coughing with eating</td>
<td>1.3 (0.64)</td>
</tr>
<tr>
<td>Swallowing stressful</td>
<td>1.1 (1.10)</td>
</tr>
</tbody>
</table>

Contributing Factors:

Eating with M-NPPV (n=10)
Eating with BPAP (n=7)
Two Primary Themes

- NPPV disrupts breathing-swallowing coordination
- M-NPPV aids cough effectiveness

1. NPPV disrupts breathing-swallowing coordination
   - Difficult to coordinate swallowing with ventilator delivered inspirations
   - Time needed to chew solid foods → dyspnea & fatigue
   - Most report M-NPPV Easier

Two Primary Themes

M-NPPV aids cough effectiveness

- With or without breathstacking
- All report they have been pneumonia free with optimal NPPV use

VIDEO: M-NPPV: Coordination with solid foods

"You gotta focus or pay attention" to avoid having the "food blow back into your throat."

"I wanna make sure I don’t take a drink while the air is going, like when it pushes air in because it can, like, it can get shoved into your lungs."

"That’s aspiration waiting to happen."

"Now that I use NPPV with every breath, it is easier. I just alternate breaths with swallowing. I usually take a breath before I swallow."

"You just have to be mindful of timing it so that it doesn’t activate when you’re trying to eat something."

"Sometimes I will confuse the two and go grab the ventilator when I’m trying to drink or I’ve also sometimes breathed in water because I thought it was the ventilator."

"You just have to be mindful of timing it so that it doesn’t activate when you’re trying to eat something."

"Sometimes I will confuse the two and go grab the ventilator when I’m trying to drink or I’ve also sometimes breathed in water because I thought it was the ventilator."
“Before I got this (mouthpiece NPPV), I was prone to pneumonia, and I just got pneumonia one too many times. Every time I got sick, I got a little weaker.”

**VIDEO: M-NPPV: IMPROVED ABILITY TO COUGH**

**POSSIBLE REDUCED RISK FOR PNEUMONIA**

From the perspective of individuals with MD:
- Breathing-swallowing coordination is challenging with both forms of NPPV, but less challenging with M-NPPV
- M-NPPV may aid cough effectiveness
- NPPV use may reduce risk for pneumonia

**Swallowing with NPPV**

**Conclusions**

- Impact on breathing swallowing coordination
- ↓ Pulmonary defenses, e.g., ability to cough
- ↓ Subglottic pressure support
- ↑ risk for pneumonia

**Impact of respiratory impairments on swallowing**

**Coordination of Breathing & Swallowing: Swallow Apnea Duration**

**Coordination of Breathing & Swallowing: Respiratory Phase Pattern**
Subglottic pressure support for swallowing

Facilitates healthy swallowing
- May aid expiratory airflow following swallow apnea (Lang et al. 2002; Nishino & Honda, 1986)
- May stimulate mechanoreceptors to aid laryngeal adduction (Shin et al., 1988)
- Swallowing timing and efficiency is aided by higher lung volume (Gross, 2009; Terzi et al., 2007)

ROLE OF THE SPEECH-LANGUAGE PATHOLOGIST

- Consideration of all factors which may impact speech, communication or swallowing function is within the scope of practice for speech pathology.
- But, what about the paucity of research regarding the impact of NPPV on speech and swallowing so far?

ROLE OF THE SPEECH-LANGUAGE PATHOLOGIST (SLP)

Assessment

- Medical knowledge critical to clinical decision making:
  - Clinical research
  - Pathophysiologic reasoning
  - Clinical experience
- Other important considerations:
  - Patient and/or family preferences
  - System features or limits, e.g., coverage or resources

Role of the Speech-Language Pathologist (SLP) Intervention

When medically feasible (discuss with MD), consider...
- Adjustments to interface, e.g., type of mouthpiece, mouthpiece positioning
- Also, advocate for M-NPPV trial for patients with adequate bulbar function who are using BPAP during daytime hours
- Strategies to minimize complications, e.g., aerophagia, oral dryness
- Functional use of NPPV to aid speech & swallowing, e.g., frequency of breaths, breathstacking to aid cough
- Strategies to aid coordination of breathing and swallowing with NPPV use

QUESTIONS & WRAP UP
Thanks for your attention!