Hemifacial Spasm Effects of Botox + Surgery on Bilingual Speech: A clinical case study

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What is Hemifacial Spasm (HFS)?

- HFS is a hyperkinetic movement disorder characterized by involuntary spasms
- HFS affects the muscles innervated by the facial nerve (CN VII)
- Clonic vs. Tonic
Etiology + Clinical Presentation of Hemifacial Spasm

• Most common etiology of HFS:
  – contact between a blood vessel + the root exit zone of the facial nerve

• Arterial compression on facial nerve
  – secondary to arterial dilation or hardening

• Arteries most commonly involved:
  – AICA, PICA, and vertebral artery

Tunc et al. (2008)
Anatomical Layout of CN VII and Nearby Arteries
According to Sauvain et al. (2001) Tan et al. (2002)

- **A typical spasm...**
  - is initially characterized by involuntary twitching of the orbicularis oculi
  - is initially clonic in nature followed by a tonic phase resulting in ipsilateral forced closure of the eye
  - gradually increases in intensity and begins to affect other muscles on the ipsilateral face

“Emotional stress, voluntary contraction of any facial muscles, and fatigue make it worse. The severity of the spasm fluctuates but tends generally to worsen with time” (Sauvain et al., 2001)
Orbicularis Oculi + associated musculature
Diagnosis of Hemifacial Spasm

- MRI
- Neurological features
- Clinical symptoms
  - facial +/- speech (Duffy, 2005)
- Differential diagnosis
Current Treatments

- Oral medications
  - Anti-convulsants
- Botulinum Toxin injections
- Microvascular decompression
Botox Tx

- Produces temporary weakness of facial muscles
- Lasts ~3-4 months → need continuous injections

Commonly reported side effects include:
- dry eyes, ptosis (CN VII)
- facial muscle weakness and +/- lip/mouth droop (CN VII)

- Botox can be used over a long period without major side effects

Ward et al. (2006), Tan et al. (2002)
Surgical Tx of HFS
Microvascular Decompression

- Provides more effective/long-term solution
- Introduces barrier → CN VII and oppressing artery
- Success rate = 85% - 97%

Frei et al. (2006); Park et al. (2008); Heuser et al. (2007)
Microvascular Decompression

Sauvain et al. (2001)
Clinical Case Study

Participant: Mr. T
Gender: Male
Age: 50-years old
Native Language:
  – L1 (Cantonese) + L2 (MAE)
Education: MBA (18+)
Occupation: Higher Education Administration
PMH: Unremarkable
Presenting Problem: Accent Reduction
Differential Diagnosis

• Self-referred to Center for Language, Speech, and Hearing in March of 2006 for accent reduction
  – SLP referred to neurology
  – Cultural considerations

• MRI scan with/without contrast in 1999
  – “Ectatic L-vertebral artery....compressing the facial nerve” (Basquis, G., 1999) → Hemifacial Spasm

• Botox Treatment: 1999- May 2007 (~8 yrs)

• Microvascular surgical decompression - October 2007

• Patient Tx + studied: pre-op, post-op + F/U speech including neuromotor monitoring
Research Question:

• Is reduced intelligibility due to:

  – L1 (Cantonese) + L2 (MAE)
  – Hemifacial spasm (chronic)
  – Botox Tx (long-term)
  – Combination of these variables?
Procedures/Measurements

• Motor Speech Evaluation:
  – Oral Periph-NeuroMotor Speech Examination
  – Ordinal numeric data (+/- 0 to 4 scale)

• Speech Evaluation:
  – Assessment of Intelligibility of Dysarthric Speech (AIDS)
    – Percentage scores
  – Photo Articulation Test, 3rd Edition (PAT-3)
    – Standard Scores

• Audiological Evaluation:
  – Typanometry
  – Test of Acoustic Reflexes
Botox Tx Protocol for Mr. T

- Administered under EMG guidance
  - (Baquis, G., 2000)

- First injection: 18.57 units (May 1999)

- Final injection: 32.5 units (May 2007)
Botox Intramuscular Placement

- L Procerus
- L Orbicularis Oculi Superior (medial)
- L Orbicularis Oculi Superior (lateral)
- L Orbicularis Oculi Superior (palpebral)
- L Orbicularis Oculi Inferior (medial)
- L Orbicularis Oculi Inferior (lateral)
- L Levator Labii Superioris
Botox Intramuscular Placement

- L Platysma
- L Frontalis
- L Depressor Anguli Oris
- L Corrugator Supercilii
- L Levator Anguli Oris
- L Zygomaticus Major
- L Mentalis
Botox injections
L- Suboccipital Craniotomy for Microvascular Decompression of Facial Nerve

- BAER monitoring intra-operatively
- Burr hole placed in suboccipital position
- Root entry of CN VII was compressed by L- PICA + L-Vertebral Basilar Junction
- Placed Teflon pledget between:
  - L-Vertebral artery and lateral medulla (inf. To CN IX, X)
  - L-Vertebral Basilar Junction + brainstem
- Bone flap replaced
History of Botox

8/16/07 – 2 mos pre-op Sp Eval
Moderate Mixed Dysarthria
Hyperkinetic + Flaccid

9/4/07 – 1 mos pre-op Aud Eval
L tymp – ↓ compliance
↑ / - acoustic reflexes
Contra-/ipsilateral

10/5/07
Microvascular Decompression

10/12/07 – 1 wk post-op Sp Eval
Moderate to Marked
Flaccid Dysarthria

11/21/07 – 1 mos post-op Sp Eval
Mild Flaccid Dysarthria

1/11/08 – 3 mos post-op Aud Eval
L tymp – ↓ compliance
Acoustic Reflexes WFL Bilaterally

3/6/08 – 5 mos post-op Sp Eval
No Dysarthria

→ Speech
→ Audiology
→ Botox + Surgical Tx
### Neuromotor Examination Results (Mayo Clinic Procedures, 2005)

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<thead>
<tr>
<th>2 mo pre-op</th>
<th>Right</th>
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<tbody>
<tr>
<td>Smile</td>
<td>-1</td>
<td>-2/-3</td>
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<tr>
<td>Rounding</td>
<td>WFL</td>
<td>-1/-2</td>
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<td>Puffing</td>
<td>WFL</td>
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<td>Eye</td>
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<td>Forehead</td>
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<td>Tongue</td>
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<td>Smile</td>
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<td>Tongue</td>
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<th>5 mo post-op</th>
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<td>Tongue</td>
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## Results of Accuracy (PAT-3) and Intelligibility (AIDS)

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<tr>
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<th>2 month pre-op</th>
<th>1 week post-op</th>
<th>1 month post-op</th>
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<td><strong>Accuracy:</strong></td>
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<td>&lt;60</td>
<td>&lt;60</td>
<td>80</td>
<td>70</td>
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<td><strong>Std. Scores</strong></td>
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<td><strong>Word Level</strong></td>
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<tr>
<td><strong>Intelligibility</strong></td>
<td>67%</td>
<td>73%</td>
<td>76%</td>
<td>71%*</td>
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<td><strong>Sentence</strong></td>
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<tr>
<td><strong>Level Intelligibility</strong></td>
<td>70%</td>
<td>95.5%</td>
<td>99.5%</td>
<td>100%</td>
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* Poor audio recording
Conclusion/Discussion

• Accuracy vs. Intelligibility

• $L_2$ (Differences) vs. Dysarthria

• Speech Tx vs. Botox vs. Surgery

• Prognosis $\rightarrow$ Good!
Limitations of the Study

- **Small sample size**
  - Yet, we have good subjective and objective data to note improvement over time
  - Excellent inter-judge reliability
    - Point to point agreement = 98.5%

- **EBP = patient progress monitoring**
  - Patients referred for accent reduction need thorough oral + neuromotor examinations

- **SLP plays critical role in Dx + Tx speech disorders in the context of speech differences**
References