Vocal expression of emotions in Unilateral Vocal Fold Paralysis

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Introduction

1. Emotional prosody
Basic emotions associated to systematic prosodic modulations [1,2], e.g.:
• Anger -> increase in the fundamental frequency (f0) mean, higher intensity, and harsh/tense voice compared to a neutral emotional state
• Sadness -> decrease in f0 and intensity, increase in breathiness

2. Unilateral Vocal Fold Paralysis (UVFP)
• Immobility of one of the vocal folds [3,4] -> instability in the vibratory pattern
• Dysphonia, weak voice, breathiness, roughness, diminished voice intensity, diplaphonia, air loss [5, 6]
• Higher values of jitter and shimmer, lower values of the harmonic-to-noise ratio (HNR) and lower f0 range compared to healthy controls [6, 7; cf. also 8]
• UVFP patients complain of a mismatch between the emotion they intend to express and the emotion conveyed through their voice (Mattei, p.c.)

AIM: Exploratory study on the impact of UVFP in the vocal expression of emotions

Acoustic study

Materials:
• 8 short sentences with verbal neutral meaning
• Same syntactic structure, e.g., if va rentrer chez lui (“He is going back home”)
• Three emotional states, elicited by three context types:

<table>
<thead>
<tr>
<th>Neutral</th>
<th>Angry</th>
<th>Sad</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vincent, your best friend has promised to visit some flats with you. However, you receive a call from him: he is tired and is going back home. Annoy, you call your partner and tell him/her: You had a great week with your partner but now it is time to say goodbye because he/she has to go back home. Sad, you say to a friend:</td>
<td></td>
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</table>

Procedure [9]:
• Participants read contexts and target sentences silently, and produced the target sentences without repeat
• Sentences presented in 3 different blocks of emotional states. The intended emotion was indicated at the beginning of each block, and each block was preceded by a familiarization and a training phase
• Within each block, sentences were presented in a random order

> 480 utterances (8 sentences X 3 emotions X 10 participants X 2 repetitions)

Measure:
At the midpoint of vowel /a/ of the word va (“going”)
• Harmonic to noise ratio (HNR) over 1kHz
• f0 via FCN-10 [10, 11]
• 0-5kHz spectrum computed on 20Hz bins; comparisons based on correlation coefficient
• Smoothed cepstral peak prominence (CPPS)

Statistics:
Linear mixed models testing Group (HC/UVFP), Emotion (neutral/anger/sadness) and their interaction + post-hoc comparisons (p-values adjusted using Tukey’s method)

Discussion

Reduced prosodic modulations for UVFP patients:
• Smaller range of f0 variations, less distinct spectral shape, poorer harmonic structure; linked to global decrease in f0 control and increase in breathiness and roughness
• Stronger impact on the expression of hot anger; crucial role of voice quality for expressing anger [1, 2]

In line with patients’ informal observations that UVFP has a negative impact on their ability to convey emotions

Future perspectives: Perceptual evaluation of the corpus; acoustic analyses before and after vocal cord medialization

Materials

<table>
<thead>
<tr>
<th>HC/anger</th>
<th>UVFP/anger</th>
</tr>
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<tbody>
<tr>
<td>“He is going back home”</td>
<td></td>
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</table>

Participants

Demographics
• UVFP n = 10
• HC n = 10
• Age
  - HC: 66 (7.8)
  - UVFP: 65.3 (7.3)
• Gender
  - UVFP: 5 F + 5 M
  - HC: 5 F + 5 M
• Disease Duration (months)
  - UVFP: 579.2 (21.5)
  - HC: 37.1 (7.7)

Inclusion criteria for UVFP:
• post-operative UVFP, with no dysarthria, no neurological or psychiatric disorders.

Results

![Graph showing emotional impact of voice impairment (VHI-30) and depression (PHQ-9).](image)

References