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Functional impact of speech disorders in patients treated for oral or oropharyngeal cancer, assessed by perceptual and automatic measurements

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Oral and oropharyngeal cancer affects anatomical regions involved in speech production. Alterations of communicational functions lead to a major impact on patients’ quality of life [1]:
- Little research on functional impact of speech disorders
- Moderate correlations between quality of life and speech disorder severity scores (assessed perceptually) [2]

But standard perceptual assessment shows several limitations, among which low intra- and inter-rater reliability. The development of tools for automatic speech signal assessment can overcome these limitations [3].

Purpose

To analyze the correlations between patients’ quality of life and the speech disorder severity scores, assessed perceptually and automatically.

Methods

Database: C2SI project [2]
87 patients treated for oral (40%) or oropharyngeal (60%) cancer (59% male, mean age = 65.8, SD = 9.6)
- Patients’ speech recorded on different tasks, including sustained vowel “a”, repetition of pseudo-words, text reading and picture description
- Overall quality of life questionnaire: MOS SF-36 [4], including a “social role functioning” dimension ("SF36-SF")
- Two specific questionnaires related to speech:
  - Speech Handicap Index, SHI [5]
  - Phonation Handicap Index, PHI [6]

Quality of life and speech-related impairment

Spearman correlation

<table>
<thead>
<tr>
<th>Perceptual assessment</th>
<th>Automatic assessment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Speech disorder severity score given by 6 experts</td>
<td>Severity score given by an automatic speech signal analysis: C2SI score</td>
</tr>
</tbody>
</table>

On:
- A semi-spontaneous task (picture description)
- Pseudoword repetition
- Text reading
- Sustained vowel “a”

Perceptual and C2SI scores ranging from 0 (no impairment) to 10 (maximum impairment)

Results

<table>
<thead>
<tr>
<th>Spearman correlation coefficients</th>
<th>Quality of life</th>
<th>Speech-related quality of life</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>SF36-SF: &quot;social role functioning&quot;</td>
<td>Functional dimensions</td>
</tr>
<tr>
<td></td>
<td>r = .13</td>
<td>PHI</td>
</tr>
<tr>
<td>r = -.50</td>
<td>Moderate correlation</td>
<td>Low correlation</td>
</tr>
<tr>
<td>r = -.39</td>
<td>Moderate correlation</td>
<td>Low correlation</td>
</tr>
<tr>
<td>r = -.45</td>
<td>Low correlation</td>
<td>Low correlation</td>
</tr>
<tr>
<td>r = -.43</td>
<td>Low correlation</td>
<td>Low correlation</td>
</tr>
</tbody>
</table>

Automatic C2SI score

<table>
<thead>
<tr>
<th>Perceptual score</th>
<th>Automatic C2SI score</th>
</tr>
</thead>
<tbody>
<tr>
<td>r = .31</td>
<td>Low correlation (Figure 1)</td>
</tr>
<tr>
<td>r = -.52</td>
<td>Moderate correlation</td>
</tr>
<tr>
<td>r = -.39</td>
<td>Moderate correlation</td>
</tr>
<tr>
<td>r = -.45</td>
<td>Low correlation</td>
</tr>
<tr>
<td>r = -.42</td>
<td>Low correlation</td>
</tr>
</tbody>
</table>

Figure 1: Scatter plot of automatic C2SI score and SF36-SF

Discussion

Only low or moderate correlation between quality of life and speech disorder severity scores:
- International Classification of Functioning: Intermediate level between deficits and quality of life is about functional impact
- In terms of speech disorders: Need to consider the functional impact on communication during everyday activities

Development of comprehensive models combining various acoustic measures:
- Analyses to be carried out to find out which measures are relevant in conversational speech (natural context of speech production)
- Include functional impact measures in the models to determine thresholds for speech disorder severity according to the functional impact on communicational acts
- Innovative objective tools including communicational impairment cues will improve current clinical practice by customizing patient care (adaptation to the patients’ needs from the diagnosis)

References