The prevalence of Impaired speech production in people with MS (PwMS) and 9 age-matched controls (all female). Participants were guided through a survey instrument. Speech acoustic and facial kinematic metrics were automatically extracted.

- RRMS = Relapsing-Remitting MS, SPMS = Secondary Progressive MS

<table>
<thead>
<tr>
<th>Demographics</th>
<th>PwMS</th>
<th>Controls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td>9 (7 RRMS, 2 SPMS)</td>
<td>9</td>
</tr>
<tr>
<td>Mean ± standard deviation (years)</td>
<td>40.2 ± 8.44</td>
<td>40.1 ± 8.25</td>
</tr>
<tr>
<td>Median Schwab and England score (Q1-Q3)</td>
<td>90 (70-90)</td>
<td>100 (80-100)</td>
</tr>
<tr>
<td>Median CPIB-S score (Q1-Q3)</td>
<td>5 (4-9)</td>
<td>1 (0-10)</td>
</tr>
</tbody>
</table>

Table 1: Demographics

- The sample size in this exploratory study is very small and future studies with larger cohorts will be needed to confirm the findings.

- These findings support the feasibility of assessing and monitoring objective measures of atypical speech production in MS through the use of a novel multimodal conversational technology.

**Results and Discussion**

- A variety of metrics showed statistically significant differences between PwMS and controls (Figure 2) at an alpha threshold of 0.01 and were controlled for false discovery rate.

- PwMS showed greater values of higher-order derivatives of the vertical movement of the jaw (acceleration and jerk) during the production of /ɛ/ and /ʊ/ CVC words, indicating lack of smoothness in movement.

- PwMS exhibited shorter articulatory duration during spontaneous speech production accompanied by a larger percentage of pause duration.

- Wider mouth opening in PwMS during sustained phonation of /ɑ/.

- Lower cepstral peak prominence (CPP) in PwMS during sustained phonation of /ɑ/, indicating a relative degradation in voice quality.

**Conclusions and Limitations**

- The precedence of dysarthria in Multiple Sclerosis (MS) is around 45% with most people manifesting mild severity.

- Impaired speech production in people with MS (PwMS) impacts quality of life, highlighting the need to define speech-related biomarkers for remote patient monitoring, tracking disease progression and the outcomes of therapeutic interventions.

- Exploratory study investigating the feasibility of a multimodal dialogue platform with real-time extraction of speech acoustic and facial kinematic metrics in assessing impaired speech motor control in MS.

**Methods and Materials**

- 9 PwMS and 9 age-matched controls (all female) completed an interactive session in December 2021 and January 2022 using a cloud-based multimodal dialogue platform (Illustration in Figure 1).

- Participants were guided through a battery of tasks eliciting speech and facial behaviours: sustained vowel phonation, counting up numbers in a single breath, repeating consonant-vowel-consonant (CVC) words, alternating-motion rate diadochokinesis, reading sentences and passages, picture description, spontaneous speech on a topic of their choice.


- Speech acoustic and facial kinematic metrics were automatically extracted (Table 2). Facial metrics were normalised for each participant by the inter-caruncular distance between the eyes. Non-parametric Kruskal-Wallis tests were performed to investigate differences between PwMS and controls.

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**References**


