Purpose/Rationale
This presentation describes the development of a Safe Laser Keyboard prototype and through case illustration, the use of this prototype system as a functional communication alternative for one individual with critical medical conditions.

Prototype Design Features
- Access with minimal movement
- Support low-tech communication boards without speech output
- Support communication boards with digitized speech output
- Support letter-by-letter text generation on a conventional laptop or desktop computer
- Support environmental “pointing”
- Tetraplegic
- Ventilator dependent—unable to tolerate talking valve
- Communicated by mouthing and using partner-dependent scanning with a low-tech AAC.
- Trial use of eye gaze and head tracking (Vmax with Eye Max accessory and HeadMouse Extreme). Unable to consistently calibrate the eye gaze system. Able to use the HeadMouse but would quickly fatigue due to extensive head movements required. Staff had difficulty setting up and maintaining the Vmax system in the acute medical setting.
- Safe Laser Keyboard prototype was introduced as simplified method for AAC.

Methods

Participants
- 46-year-old female—diagnosis of paraneoplastic syndrome (mimics the degenerative path of ALS.
- Tetraplegic
- Ventilator dependent—unable to tolerate talking valve
- Communicated by mouthing and using partner-dependent scanning with a low-tech AAC.
- Trial use of eye gaze and head tracking (Vmax with Eye Max accessory and HeadMouse Extreme). Unable to consistently calibrate the eye gaze system. Able to use the HeadMouse but would quickly fatigue due to extensive head movements required. Staff had difficulty setting up and maintaining the Vmax system in the acute medical setting.
- Safe Laser Keyboard prototype was introduced as simplified method for AAC.

Procedures/Data Collection
1) Amount of physical ability required to use the Safe Laser Keyboard compared to the head tracking (HeadMouse) system as measured by inches of excursion from the tip of the nose,
2) Rate and accuracy spelling five sentences from HINT list 2 using both systems,
3) Communication functions served by the prototype,
4) Use of the prototype to facilitate communication regarding environmental information (i.e., pictures on the wall, cards, flowers, notes from nursing staff, calendar), and
5) Ease of use, fatigue, and ease of set-up

Results

<table>
<thead>
<tr>
<th>Movement Excursion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Safe Laser Keyboard prototype:</td>
</tr>
<tr>
<td>Vmax/HeadMouse:</td>
</tr>
<tr>
<td>2” left/right 1” up/down</td>
</tr>
<tr>
<td>4” left/right 3” up/down</td>
</tr>
<tr>
<td>Vmax/HeadMouse:</td>
</tr>
<tr>
<td>*additional “quick” 2-inch movements required to recalibrate</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Rate and Accuracy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vmax/HeadMouse:</td>
</tr>
<tr>
<td>*dwell time was set for 1 sec. for both devices</td>
</tr>
<tr>
<td>Safe Laser Keyboard prototype:</td>
</tr>
<tr>
<td>16 self corrections, average of 1.15 minutes per sentence</td>
</tr>
<tr>
<td>65 self corrections, average of 2.53 minutes per sentence</td>
</tr>
</tbody>
</table>

Communication Functions
1. Spell messages related to care, detailed needs, and social communication with family.
2. Communicate basic and detailed needs and ask questions regarding medical condition to staff (nursing and respiratory).
3. The participant, family, and staff indicated that the effectiveness of communicative interactions was greater using the Safe Laser Keyboard compared to low-tech AAC strategies (e.g., less frustrations, less misinterpreted messages, less repetitions required).
4. Used the prototype to point to objects in the environment on several occasions during trial (e.g., pointing to a picture on the wall to clarify topic of conversation, pointing to calendar on wall to clarify appointment).

Discussion
The Safe Laser Keyboard prototype demonstrates potential to serve as a simplified AAC system for individuals with critical medical conditions due to its ease of use, low fatigue with use, and ease of set-up for caregivers. An additional benefit is also related to its ability to point to objects in the environment to facilitate communication.

Ease of Use, Fatigue, Ease of Set-up
- Ease of use (1= very easy, 5= very hard)
  - Safe Laser Keyboard prototype= 1
  - Vmax/HeadMouse= 4
- Fatigue (1= no fatigue, 5= very fatiguing)
  - Safe Laser Keyboard prototype= 2
  - Vmax/HeadMouse= 4
- Ease of Set-up (1= very easy to set up, 5= very difficult to set up)
  - Safe Laser Keyboard prototype= 1
  - Vmax/HeadMouse= 3

Acknowledgements
- Thanks to the participant and her family, as well as the staff at Madonna Rehabilitation Hospital, Lincoln, Nebraska.
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