AAC-RERC Webcast Series

Children’s Hospital at Boston, Duke University, InvoTek, Inc., Oregon Health and Science University, Pennsylvania State University, State University of New York at Buffalo, University of Nebraska at Lincoln

Supporting Communication of Individuals with Minimal Movement

Institute for Rehabilitation Science and Engineering at Madonna Rehabilitation Hospital

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http://aac-rerc.com
Supporting Communication of Individuals with Minimal Movement

Introduction
- Discuss research and development projects
- Webcast is supported by AAC-RERC which is funded by NIDRR
- Thanks to Olinda, Merle, and John
- Thanks to Tom Jakobs, Laura Ball, Amy Nordness, and Vicki Phillipi

New Interface Project
AAC Tech Connect
- http://www.aactechconnect.com/

Etiology
- Brainstem stroke
- Guillain Barre'
- Amyotrophic Lateral Sclerosis (ALS)
- Severe Traumatic Brain Injury
Challenges

- Medical instability
- Fatigue/endurance
- Limited movement capabilities
- Positioning
- Technology training/on-going support


AAC Decision-Making Brainstem Impairment

*(Culp, Beukelman, & Fager, 2007)*

- Initial Assessment
  - Establishment of yes/no response mode
  - Nurse call system
  - Consistent/reliable response modality

Early Intervention

- Low tech communication systems
  - Eye gaze, eye linking, partner-dependent scanning
- Probe use of high tech AAC
  - Challenges: fatigue, medical instability
- Education
  - Impact of fatigue on performance
  - Altering intervention schedules (brief interventions with rest periods)
Formal Assessment
- Funding considerations
- Long-term placement significantly impact SGD funding options
- Technology to accommodate minimal movement
- Maintenance and care of technology
- SNF- challenges with staff turn-over, technology training
- Establishment of communication advocate

Ongoing Assessment
- Customization of technology
- Training staff, caregivers, communication advocates
- Educate for modifications over time
- Increases in motor function
- Changes in speech
- Establish long-term support system

Access Methods to Support AAC
- Head tracking technology
- Eye tracking technology
- Switch scanning

Head Tracking
Safe-laser Access System
Safe Laser Access System

Components:
- Laser pointer
- Laser sensing module

Features:
- Eye-safe laser
- Low power except when pointing at a laser sensing surface

Initial Prototype (phase I prototype)

- Laser pointer
- Laser sensing surface
- Low tech pointing

3 Areas of Exploration

- Primary Communication System
- Head Movement Training
- Transitional System
Initial case study
(head training and primary communication system)

- Merle
  - Sustained brainstem stroke
  - Locked-In Syndrome
  - Introduced Safe-laser Access System
    2.5 months post onset
  - Used as low tech pointing system

Safe-Laser Vertical Message Alignment

Safe Laser - Alphabet Spelling

Safe-laser and Head Movement Training
Participants

- 7 individuals with a diagnosis of LIS due to brainstem stroke
- 1 female, 6 males
- Age 30-66 years
- 4 weeks to 18 years post onset
- 1 lived at home, 6 lived in long-term care facilities

Evaluation Protocol

- Interface displays for the safe laser system consisted of 2, 4, 8 and 32 cells
- Data collected on the following
  - Movement range and accuracy across the interface
  - Consistency of laser movement
  - Estimates (family and staff) of laser use for communication
  - Health status throughout evaluation

Head Tracking
AccuPoint Tracker
Absolute Head Tracking
Preliminary Case Study

Participant
- 60 year-old male chronic Guillain Barre
- Initial onset locked-in syndrome
- 4 months post onset- used minimal head movement to activate light-touch switch
- 6 months post onset- increased activity tolerance and head movement to trial head tracking technology

Challenges
- Required head tracking for minimal head movement
- Unable to use head tracking that required frequent recalibration
- Required access to computer while in various positions throughout the day (up in wheelchair, supine, etc.)
- Required simple technological set-up in skilled nursing environment

AccuPoint Prototype
- Two infra-red digital cameras
- Three reflective dots on forehead
- Conventional computer monitor
- Conventional computer to compute head location and align it with the computer cursor

Results
- Calibration
  - Full computer access with scaling of 10:1
  - Minimal head excursion (measured from tip of nose) was ¼ in left/right and up and 1/8 in down
- Positioning
  - Successful with calibration and use regardless of position (wheelchair, bed, supine, side-lying)
- Communication Functions
  - Written communication throughout the day when one-way valve in use
  - Email communication
  - Internet use
  - Face-to-face communication at night when one-way valve not in use
Results

- Set-up/Staff Training
  - One training session with patient and staff
  - Patient trained all other staff independently on set-up
- Duration of Use
  - Email/internet 2 hours/day
  - Face-to-face communication 8-10 hours in evening and over-night

Eyelinking

- Set-up/Staff Training
  - One training session with patient and staff
  - Patient trained all other staff independently on set-up
- Duration of Use
  - Email/internet 2 hours/day
  - Face-to-face communication 8-10 hours in evening and over-night
  - Video will play in top right corner

Related Technology Developments

- AccuPoint
- AccuClick
- AccuKeys
Eye training technology and ALS - preliminary follow-up study

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Amy Nordness, M.S. CCC-SLP
David Beukelman, Ph.D. CCC-SLP
Susan Fager, Ph.D. CCC-SLP

Olinda Introduction

- ALS
- 60 years
- Originally a scanning AAC system
- Eye-tracking AAC system for two years

Olinda

- ALS
- 60 years
- Originally a scanning AAC system
- Eye-tracking AAC system for two years

Video will appear in top right corner

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**AAC Decision Making in ALS**
(Ball, Beukelman, & Baadsoe, 2007)
In D. Beukelman, K. Yorkston, & K. Garrett (Eds)

- **Phase I:** monitor speech performance, preserve natural speech effectiveness, and educate about AAC
  - Energy conservation
  - Environmental modifications
  - Voice amplification
  - Ongoing monitoring/assessment of speaking rate

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**All Types of ALS**
Intelligibility and Speaking Rate

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**ALS: Intelligibility & Months Post Dx**

- **Phase II:** Formal AAC Assessment
  - Assessing specific communication needs
  - Cognitive issues (frontotemporal dementia)
  - Support and environment
  - Including information regarding life plans (e.g., decisions regarding artificial ventilation)

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Phase III: Finalization of AAC Recommendations
- Device trials, preparation of necessary paperwork, funding requests, prescriptions, etc.
- High and low tech AAC options recommended and implemented

Eye Tracking AAC Technology: An Outcome Study
- The purpose of this study was to report on 15 persons with ALS who selected eye-tracking (ERICA SGD) as their means of augmentative communication.
- Note: ERICA (Single Camera, Type and Talk)

Background
- Eye gaze access SGDs are particularly attractive to persons who have severe physical impairments (ALS, LIS) that limit other access options.
- Eye tracking technology in SGDs most commonly employs infrared illumination of the pupil or cornea with digital camera tracking integrated into a computer.

Clinician-reported issues with early models of eye gaze technology
- physical abilities (head movement, ventilators)
- eyes (e.g., ptosis, visual apraxia, dry eyes)
- environment (e.g., home vs. community)
- positioning (e.g., head position, distance)
- glasses use (e.g., frame reflection, soiled contacts)
- lighting (e.g., dark room, window proximity)
Participants

- 15 selected eye-tracking (ERICA)

<table>
<thead>
<tr>
<th>Gender</th>
<th>10♂, 5♀</th>
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<tbody>
<tr>
<td>Age</td>
<td>52.9 (39-71) years</td>
</tr>
<tr>
<td>Length of Use @ Survey</td>
<td>7.6 (1-26) months</td>
</tr>
<tr>
<td>Ventilator Use</td>
<td>6 (40%)</td>
</tr>
<tr>
<td>Predominant Muscle Tone</td>
<td>53% spastic, 47% flaccid</td>
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Participants

- Received personal AAC device
- Received instruction until they could operate devices to communicate
- Were provided with trouble-shooting as needed

Interview Survey

- Participants were interviewed by the SLP who completed the AAC evaluation and assisted in setup and instruction of the ERICA.
- Interview survey was completed in one session, and required approximately 1 hour of the participant's time.

Results

- Successful Use
  - 14 became successful ERICA communicators.
  - 1 discontinued use because of difficulty controlling eye lids.
- Light Compensations were required for most participants, with 14/15 using low light:
  - 10 = dim lights/lower shades
  - 4 = switched to fluorescent bulbs at home
  - 3 = used overhead lighting
- **Glasses**
  - 53% wore prescription glasses
  - 3 of these had reflective lenses.
  - Of these, 2 indicated that glasses interfere with ERICA use, and 1 uses without glasses.

- **Reasons for Technology Selection**
  - 58% - eye gaze access only,
  - 27% - multiple access,
  - 13% - unable to scan,
  - 7% - wanted eye + head access.

- **Funding**
  - 7 - Medicare,
  - 4 - Medicaid, 3 Private Insurance
  - 1 - Veterans Administration.

- **Instruction**
  - Mean training received from SLP = 5.67 hrs (2-20).

- Increased instruction needed when primary facilitator was not a family member.
- Increased instruction/practice needed with ocular apraxia.
Troubleshooting Issues
- Lighting
- Positioning
- Care facilities vs. home

Home use sites:
- 5 - recliner/lift chair only
- 4 - everywhere
- 4 - bed only
- 1 - wheelchair only
- 1 - table only

Use Patterns

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References
References


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