AAC-RERC Webcast Series

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Supporting Communication of Individuals with Minimal Movement



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Institute for Rehabilitation Science and Engineering at Madonna Rehabilitation Hospital

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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

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Introduction

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

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Minimal Movement

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

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Challenges

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

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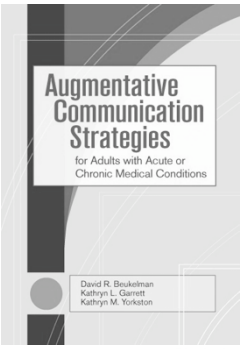
Beukelman, D., Yorkston, K., Garrett, K. (2007). *Augmentative Communication Strategies for Adults with Acute and Chronic Medical Conditions.* Paul H. Brookes Publishing Co.



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AAC Decision-Making Brainstem Impairment

(Culp, Beukelman, & Fager, 2007)

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

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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)

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- **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, comunication 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

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Safe-laser

Initial Prototype (phase I prototype)

- **Laser pointer**
- **Laser sensing surface**
- **Low tech pointing**

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3 Areas of Exploration

- **Primary Communication System**
- **Head Movement Training**
- **Transitional System**

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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

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Safe-Laser Vertical Message Alignment

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Safe Laser- Alphabet Spelling

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Safe-laser and Head Movement Training

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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**

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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

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Participants	Pre-laser AAC strategy	Length of training	Movement outcomes	Impact on AAC
1				
2				
3				
4				
5				
6				
7				

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Head Tracking AccuPoint Tracker

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Absolute Head Tracking Preliminary Case Study

Participant

- 60 year-old male chronic Guillain Barré
- 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

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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**

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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**

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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

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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

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- **Video will play in top right corner**

Results

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Related Technology Developments

- **AccuPoint**
- **AccuClick**
- **AccuKeys**

Eye training technology and ALS- preliminary follow-up study

Laura Ball, Ph.D. CCC-SLP
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
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- Video will appear in top right corner

Olinda Introduction

- **ALS**
- **60 years**
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- **Eye-tracking AAC system for two years**

AAC Decision Making in ALS

(Ball, Beukelman, & Bardach, 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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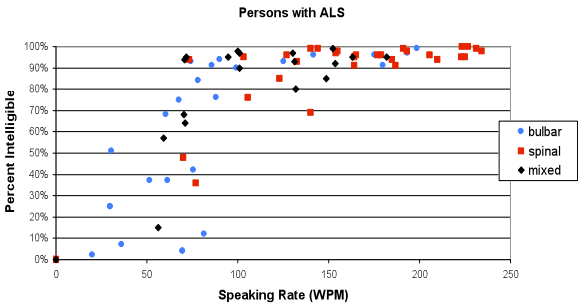
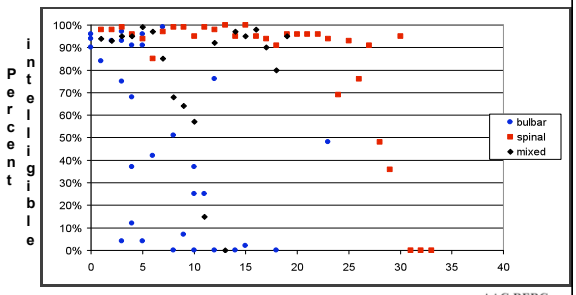
All Types of ALS Intelligibility and Speaking Rate



ALS: Intelligibility & Months Post Dx



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- **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

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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)**

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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.

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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)

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Participants

- 15 selected eye- tracking (ERICA)

Gender	10 ♂, 5 ♀
Age	52.9 (39-71)years
Length of Use @ Survey	7.6 (1-26) months
Ventilator Use	6 (40%)
Predominant Muscle Tone	53% spastic, 47% flaccid

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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

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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.

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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

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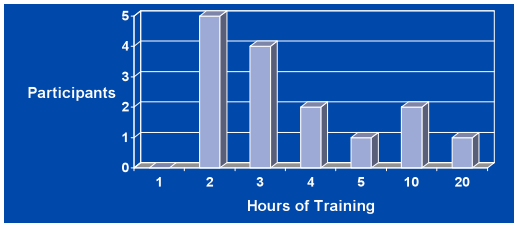
- **Glasses**
  - 53% wore prescription glasses
  - 3 of these had reflective lenses.
  - Of these, 2 indicated that glasses interfere with ERICA use, and 1 uses without glasses.

- **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

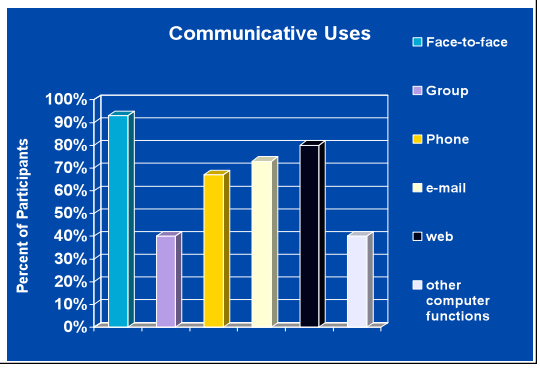
- **Mean training received from SLP = 5.67 hrs (2-20).**



- **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

- Culp, D., Beukelman, D.R., & Fager, S.K. (2007). Brainstem Impairment. In D.R. Beukelman, K.L. Garrett, & K.M. Yorkston (Eds.), *Augmentative communication strategies for adults with acute or chronic medical conditions* (pp. 59-90). Baltimore: Brookes Publishing.
- Ball, L., Beukelman, D.R., & Bardach, L. (2007). Amyotrophic Lateral Sclerosis. In D.R. Beukelman, K.L. Garrett, & K.M. Yorkston (Eds.), *Augmentative communication strategies for adults with acute or chronic medical conditions* (pp. 287-316). Baltimore: Brookes Publishing.
- Ball, L., Willis, A., Beukelman, D.R., & Pattee, G. (2001). *A protocol for early identification of bulbar signs in amyotrophic lateral sclerosis. Journal of Neurological Sciences, 191*, 43-53.

References

- Fager, S., Beukelman, D., Karantounis, R., & Jakobs, T. (2006). Use of safe-laser access technology to train head movement in persons with locked-in syndrome: A series of case reports. *Augmentative and Alternative Communication, 22,* 27-47.
- Ball, L., Fager, S., Nordness, A., Kersch, K., Mohr, B., Pattee, G., Beukelman, D., (Accepted). Eye-gaze access of AAC technology for persons with amyotrophic lateral sclerosis. *Journal Medical Speech Language Pathology*.

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