UTILIZING TELEREHABILITATION AND VIRTUAL REALITY APPROACHES FOR MOTOR AND COGNITIVE TREATMENT THROUGH THE LIFESPAN

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Instructional Personnel Disclosure

- The speakers have no relevant financial or nonfinancial interests in any of the companies or products that are presented today.
“Tele” approaches are supported throughout the lifespan

- Brings services into clients’ environment
  - Advantageous for clients with difficulty adapting to changes in routine (example: ASD)
  - Increases family involvement and partnerships
    - Client-centered approach → “Family-centered” approach
Why Use “Tele” Approaches?

- Decreases travel barriers for clients with physical or cognitive impairments
  - Key for meeting rural needs
    - Assessments/interventions for clients with mobility impairments living in distant locations are problematic due to the lack of expertise and available resources (shortage of professionals and technical resources crucial to the delivery of services) (Callas, Ricci, & Caputo, 2000).

- If receiving home services, technology can expand therapeutic approaches for therapists
Why Telerehab?

- Some conditions require daily physical activity to maintain gains and prevent declines after outpatient rehabilitation
  - Or supplement when daily therapy services are not warranted or available
A Supplement or Extension of Therapy Services

- Clients with cognitive impairments, fatigue, or low motivation tend to not finish self-administered home exercise programs
  - Adherence to these self-guided programs is low

- Note: Overall, clinicians are recommended for appropriate grading of activities
  - Evidence suggests that technology should not replace a therapist, but used as a supplement
Assistive vs Enabling Technology in “Virtual” Approaches

- The bridging between client, occupation, and the environments of the occupation
  - “Occupation” may be considered as client’s adherence to exercise or therapy programs, if their identify is perceived as a patient in recovery

- AT can be considered as an “ends” means by opening media for occupational engagement (Ex: virtual context participation or engaging in leisure using virtual gaming platforms) (Bondoc et al., 2016)
Tech Integration

■ Technology is an essential part in our clients’ lives. It is commonplace in society and sometimes expected by our clients.

■ Technology-aided therapies are a growing field of interest, and we will present 3 examples for children, adults, and older adult clients.
Timocco
For children with special needs and developmental delays
Why use virtual gaming for therapy for children?

- Increased motivation
- Provide positive feedback and experiences
- Ability to practice at home
- Allow the client to utilize routine technology
The need
A low cost gaming platform adapted for child therapy

The solution
Timocco platform with existing hardware
Timocco
Therapy goals:

Focus on activity impairments:

- Motor skills
- Communication & attention capabilities
- Cognitive abilities

Videos

- Timocco introduction:
  [http://www.youtube.com/watch?v=5WDJx1JqtT0](http://www.youtube.com/watch?v=5WDJx1JqtT0)
- Timocco in therapy (CP child develops use of weak hand):
  [http://goo.gl/EblWmT](http://goo.gl/EblWmT)
Content

- 50 games with therapeutic purposes
- Filter by age-appropriate content
  - Educational content
- Positive feedback
Adjustments and grading

- Skills-oriented
- Pace & difficulty levels
- Control for visual distractors
- Control auditory distractors
- Location of the stimuli
- Set therapy program
Functional reach adjustments

- Regulated and controlled movement
- Adjusted range of motion
- Full range tracking
Analysis tools

- Create User Profile
- Save and display results
- Analyze the performance
- Display of hands movement
- Export data
- Options for tele-monitoring
Timocco

- Benefits: Uses existing hardware
- Limitations: Requires reliable internet connection

- Case reports: 2 children improved on the BOT-2 after 20 sessions of Timocco, in a school-based setting (Benham & Gibbs, 2017)
Thank You
Mystic Isle

A ReHABILITATION Adventure
**Microsoft Kinect Sensor**

Field-of-view: 58 degrees horizontal and 45 degrees vertical

Resolution: 640x480 at 30 frames per second.
Microsoft Kinect Skeletal Tracking
Game-based rehabilitation tool

- Tailored to individual level of ability
- Option for individualized exercise prescription
- Interchangeable graphics and environments
- After action review and data management
Calibration
Performance Results

Game Results
Name: Belinda Lange
Score: 16
Avatar Type: Skeleton
Pattern: Sequential
Total Time: 38.0 seconds
Ring1 15.10 seconds
Ring2 8.97 seconds

Data file saved to folder on computer

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Mystic Isle

A ReHABILITATION Adventure
A sentence will appear at the top of the screen.

Watch the items. The items will light up in a specific order.

Select the words in order to copy the sentence.

Select the items in the order they lit up.

Remember the word that appears on the screen.

Select the OPPOSITE word.
Case-study Clinical Setting

- 68 yo female with Parkinsonism (onset in 2009)
- Intervention Dose: 8 x 1-hour sessions over 4 weeks

**Customized JewelMine Intervention**
- Cross body and backwards reaching interventions
- Dual tasking with Simon game
- Calibration to patient’s limits of stability
- Clinician programmed gem number/sequence

- Forward functional reach
  - Improved from 6 inches to 9.5 inches
  - Maintained at 4 week follow-up: 9.25 inch

- Number of falls between Pre and Post testing
  - 6 falls reported - None during reaching, turning or dual tasking
Case Study: Home Setting

- 55 year old Male, 39 months post-stroke, left hemiparesis
- Intervention Dose: 30-90 minutes/day, 3-7 days/wk – Total 6 weeks
- Customized JewelMine intervention
- Integrated well into home environment and participant’s routines
- Actual minutes played much less than dosage

![Image of a computer setup with Kinect Sensor, Monitor, Laptop, and Wireless Mouse]
Case Series: Home Setting

- Participant #1: Female, age 53, R hemiparesis, 3 years post stroke
- Participant #2: Female, age 63, 11 months post stroke, no hemiparesis, moderate expressive aphasia, mild receptive aphasia, impaired cognitive abilities
- Participant #3: Male, age 55, L hemiparesis, 2 years post stroke
- None of the participants achieved the 4 hour/week goal
- Technology Issues
Real World Comparison: Community Dwelling Older Adults

• Sample of 30 older adults
• Age: 75.2±8.6yrs (range = 59-92)
• Right hand dominant
• 2 x 2 cross-sectional design
  • 2 task conditions (virtual and real targets)
  • 2 postural demands (standing and stepping)
• Understood the importance of exercise in maintaining function and health
  (Proffitt & Lange, 2013)
• Perceived virtual environments as more engaging than real environments for reaching tasks
  (Proffitt et al., in press)
• Virtual environments required more attentional demand than real environments
  (Chen et al., in submission)
• Used different reaching strategies in virtual environments compared to real environments
  (Wade et al., in submission)
Kinect + Oculus Rift

- 14 adults without disabilities
  - 3rd person view vs. 1st person view
  - Preferred Oculus Rift
- 5 adults with chronic stroke
  - Split on preference
  - No dizziness or nausea
  - No falls
Kinect Tracking: Validation and Outcome Assessment

- 35 subjects without disabilities
### Percentage Error of Calculated Variables

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Outcome Assessment

Person with chronic stroke

Healthy Subject
RehaCom

Computerized Cognitive Training
Overview

- Mental functions of training
  - Visual Field
  - Attention
  - Memory
  - Executive Function
- Adaptable training modules
  - Will auto adapt to client’s performance
  - Includes low training levels clients with severe cognitive deficits
- Universal design keyboard for greater access for clients with motor deficits
Type of clients and delivery

- **Client Populations**
  - Cognitive deficits resulting from:
    - Acquired brain injury (TBI or stroke)
    - Degenerative neurological
    - Age-associated cognitive decline

- **Clinician supervised**
  - Should be set up with a clinician
  - Single-computer license
    - Clients supervised in rehabilitation or community-based settings, at this time
Who can supervise RehaCom?

- OTs
- SLPs
- Psychologists
- Neuropsychologists
- Physicians and Physiatrists
Features

• Screening
  • Initial baseline testing

• Semi-Automation
  • Will adjust level of difficulty to client’s performance
    • Grading is automatic
  • Options for clinician to adjust, as well
    • Clinician must set up activities for the sessions

• Reporting
  • Performance reporting including graphs
RehaCom

- Skill-based and
- Occupation-based tasks
  - Ex: Attention or Memory
  - Ex: Shopping or Driving

- Grading
  - Ex: Low levels allow for severely impaired to participate
  - Ex: High levels are more occupation-based and challenging
RehaCom

• Adapted Keyboard
  • Does not use standard keyboard (must purchase RehaCom keyboard with package)

• Some modules require a mouse
  • May use any adaptive mice (Bluetooth, touchpad, trackball, jouse, etc)
Benefits and Limitations

- **Benefits**: No internet connection required
- **Limitations**: Single use on one computer (license is not transferable)
  - So, limited use in only setting, such as community-based, with a clinician supervising
Clinicaltrials.gov
Identifier NCT03170492

• Recruiting

• The therapeutic alliance clinicians have with patients is very important to facilitate engagement with computerized cognitive training

• Clients are enjoying the personal connection to an attendant with cognitive therapeutic approaches (engagement is key)
References

