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Upper Limb Prosthetic Rehabilitation

for

Occupational Therapists: EVALUATION

Debra Latour
M.Ed. Advanced Practice of Occupational Therapy; OTR/L

Disclosures

- Consumer
- Clinician
- Contributor
- Consultant
Disclosures

- **Financial:**
  - Receives payment for this series
  - Owner, Single-Handed Solutions, LLC
  - Inventor of record of patented prosthetic technology and method of use
  - Business relationship with TRS, Boulder, CO
  - Business relationship with Handspring, Middletown, NY
  - Business relationship with Liberating Technologies Inc., Hopkinton, MA
  - Business relationship with Shriners Hospitals for Children
    - Owner of patented technology mentioned in the series

- **Non-financial**
  - Member, Upper Limb Advisory Council, Amputee Coalition of America (ACA)
    - Services mentioned in the presentation
  - Member, Association of Children’s Prosthetic Orthotic Clinics (ACPOC)
    - Services mentioned in the presentation

OT

- Critical component of UL prosthetic rehabilitation
- Rarely see an individual with an UL amputation
- Often unfamiliar with UL prosthetic technology
- Specialty training is beneficial
OT

- Limb preparation
- Adjustment-Accommodation
- Prosthetic training
  - specific tasks
  - motor skills
  - positioning
  - posture
- Accelerates the rehabilitation process
- Essential to success in functional independence and achieving quality of life.

Course SERIES Overview

- Course 1: Overview and Introduction
- Course 2: Understanding Technology
- Course 3: Evaluation
- Course 4: Management and Resources
EVALUATION

It is the third in a series building upon a foundation of understanding

- the types of limb deficiency/loss
- the diverse technologies available
- approaches to evaluation and management
- patient education and consumer advocacy

OBJECTIVES
evaluation

- Clinical Assessment
- Outcomes Measures and Tools
- Developing a Plan of Care
- Contributing to Medical Necessity
- Collaborating with Prosthetist
- Resources and References

CLINICAL ASSESSMENT

- Demographic
- Past Medical History
- Prosthetic History
- Condition of Limbs
- Occupation and Requirements
- Levels of Function
- ROM
- Strength
- Myosite Evaluation
- Functional Evaluation
- Outcomes Measures
CLINICAL ASSESSMENT

Demographic
- Name
- DOB
- CA
- Height
- Weight
- Hand dominance
- Diagnosis: reason for referral to OT

CLINICAL ASSESSMENT

Medical History
- General medical history
- Surgeries
- Co-morbidities
- Medications
- Side effects
- History of limb loss
CLINICAL ASSESSMENT

Prosthetic History

• Current prosthetic technology
  – Description
  – Wear schedule
  – Training
  – Likes/dislikes

• Past use of prosthetic technology
  – Description
  – Wear schedule
  – Training
  – Likes/dislikes

CLINICAL ASSESSMENT

Condition of Limbs

• Description
  – Scar tissue
  – Boney prominences
  – Other

• Sensation

• Pain

• Overuse
CLINICAL ASSESSMENT

Occupation and Requirements

- Education
- Occupation history
  - At time of limb loss
- Current occupation
  - Responsibilities, requirements
  - Other details

CLINICAL ASSESSMENT

Levels of Function

- Systems: Vision/Hearing/Cognition
- Developmental if pediatric
- Learning style, preferences
- Home environment
- Daily routine
- Current services: OT/PT, PCA, other
- Interests
CLINICAL ASSESSMENT

ROM

- Bilateral
- All available joints

CLINICAL ASSESSMENT

Strength

- Bilateral, available anatomy
- General MMT
- Power grip
- Pinch
CLINICAL ASSESSMENT

Myosite Evaluation

• Typically only if externally-powered technology is being considered
• Otto Bock and Touch Bionics tools

CLINICAL ASSESSMENT

Functional Evaluation

• Basic ADLs
• Instrumental ADLs
  – Home
  – Community
• Vocational
• Avocational
• Summary
• Level of ability
• ?Adaptive strategies
• With/w-o prosthesis
• With/w-o AD
• Need for assistance
• Necessity of task
• Desire to access task
CLINICAL ASSESSMENT

Standardized Outcomes Measures


• to establish the current state of measurement, a
• to propose future directions for prosthetic field

OUTCOMES MEASURES AND TOOLS

• Tests of Prosthesis Use
• Tests of Hand Function
• Tests of Satisfaction and QOL
• Pediatric Tests
• Other
HAND FUNCTION

- Assessment of Capacity for Myoelectric Control (ACMC)
- Southampton Hand Assessment Profile (SHAP)
- Carrol Observational Test
- UNB Test of Prosthetic Function-Modified
- Box and Block Test
- Jebsen-Taylor Test of Hand Function

ACMC: Hermansson et al

- Observational measure
- Amputee-specific: capacity for control of a myoelectric prosthesis
- Rasch-built 4-point capability scale
- measures the quality of performance.
- 30 gripping, releasing, holding, and coordinating items
- UL functional activity considered to be meaningful to patient
- Does not require specific supplies, completion of an intensive ACMC, 2.5–day, training workshop and test is required before the ACMC is used for clinical or research work.
- Information on the ACMC, training workshops, and scoring software for trained users can be accessed at the measure's website.
- www.acmc.se/Default.asp
SHAP: LIGHT ET AL

- observational assessment
- determines the effectiveness of a terminal device with respect to unilateral prosthetic hand function
- contains 26 self-timed prehensile tasks
- 12 are abstract-unilateral tasks with form board objects
- 14 are activities of daily living (ADL) tasks
- Several of the ADL tasks are bilateral; the sound hand must be used as a stabilizer
- Six prehensile patterns are represented in these tasks
- Minimal arm movement required: prehensile ability is primarily assessed
- 20 minutes to complete
- also suitable for use with individuals with other clinical groups
- portable kit with standardized administration protocol
- can be obtained from its developers
  
  [http://www.shap.ecs.soton.ac.uk/](http://www.shap.ecs.soton.ac.uk/)

OTHER

Carrol Observational Test

- comparison of the hand function of adult B-E amputees (1* myoelectric users) with individuals who had arm replantation posttraumatic injury
- Observation of ease performance of 33 skills, representing 7 key hand function areas
- Scoring: 4-point degree of difficulty scale
- Modifications made by Graham et al
- Eliminated 12 individual digit-dependent prehension tasks to test evaluation of performance with a prosthesis
- Modified version detected differences in manual skills levels of individuals in the amputee group
- No specific validation work carried out on the modified Carroll test
- No evidence that it has been used again in amputee populations

UNB Test

- Lake
- adapted pediatric version of the UNB Test
- created new response scale on the efficiency of prosthesis use
- added new tasks for evaluation
- reliability of the modified test was not evaluated
- demonstrated changes in performance of individuals using their UL pre- and post- functional training session compared with that of a non-therapy control group
- No further work on validation of this modified UNB test for adults has yet been published.
GENERIC HAND FUNCTION

<table>
<thead>
<tr>
<th>Box and Blocks Test</th>
<th>Jebsen-Taylor Test of Hand Function</th>
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<tbody>
<tr>
<td>• Timed test</td>
<td>• Timed test</td>
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Specific validation work has not been carried out in amputee populations with any of the manual dexterity tests, these generic measures are not presented.

Upper limb abilities

- Orthotics and Prosthetics User Survey (OPUS)
- Upper Extremity Functional Status (UEFS)
- Disabilities of the Arm, Shoulder Hand Outcome Measure (DASH)
OPUS: HEINEMANN ET AL

- original OPUS consisted of a LL functional status module, as well as satisfaction and health-related QOL
- Psychometric testing was done with prosthetic and orthotic users (combined sample of adults and children)
- not clear from this work that how many of these individuals had UL deficiencies

UEFS

- 23 B-ADL AND I-ADL UL-based skills
- 5-point degree of difficulty scale
- Recent collaborative work between Heinemann and Burger et al
- Creation, initial validation of a Rasch-based, revised module
- addition of a response option that determines whether the patient uses the prosthesis for the activity.
- Rasch analysis identified four misfitting items, two of which were bilateral activities and were removed
- Modified UEFS consists of 23 items
- 9 activities identified as purely unilateral (unaffected hand),
- 7 that are typically bimanual but can be done in a unilateral manner
- 7 activities that are truly bilateral
- Available from developer
DASH

- UL-focused functional status questionnaire
- developed through Canadian-US collaboration
- self-report format
- does not require interviewer guidance
- 30 items in the categories of UL physical function, symptoms, and social/role functioning
- 2 optional modules, sports/arts and work
- Quick-DASH: shortened 11-item version
- available free of charge, paper and online

QUALITY OF LIFE

- Trinity Amputation and Prosthesis Experience Scales (TAPES)
- Nottingham Health Profile (NHP)
- Short Form 36 Health Survey (SF-36)
- DASH: perception of disability
TAPES

- self-report, HR-QOL questionnaire
- developed by a prosthetic research team in Ireland
- designed specifically for use by adults with UL or LL amputations
- assesses psychosocial processes related to adapting to a prosthesis, activity restrictions associated with wearing a prosthesis, and to satisfaction with the prosthesis
- 54-item questionnaire
- 9 subscales: psychosocial adjustment, activity restriction, satisfaction
- 3-5point response scales are used
- separate questions on pain and general health
- 15 to 20 minutes to complete; administered in a mail-out format.
- can be accessed without cost at the development team's website
- Available at: www.tcd.ie/Psychoprosthetics/pages/tapes.html

NHP

- self-report survey for adults (ages 16 years and above)
- designed by Hunt et al in the 1980s in Great Britain
- measures perceived health status (mental, social, and functional) in population surveys and HRQOL outcomes in clinical and research contexts.
- consists of two parts
- 10 to 15 minutes to complete
- mail survey or interview
- available in numerous languages.
- Part 1: 6 subscales of 38 items
- emotional reactions, physical mobility, pain, sleep, social isolation, and energy level
- Part 2: 7 questions about the effect of health problems on various aspects of life
- yes/no response.
- Scores for each subscale are calculated on a 0 to 100 scale of worst to best QOL
- Part 1 can be used without Part 2; appears to be the section most commonly used
- Information can be obtained through its developer.
- www.atsqol.org/sections/instruments/ko/pages/nott.html
## SF-36

- Internationally-known questionnaire
- Designed in the US
- Indicator of perceived health status for individuals, age 14 years and above
- With acute or chronic adult health conditions
- 8 subscales that cover the areas of
  - physical functioning, role limitations due to physical health problems,
  - pain, general health perceptions, vitality, social function, role limitations due to
    emotional problems and mental health, emotional reactions, physical mobility,
    pain, sleep, social isolation, and energy level
- 36 items, each composed of a 5- or 6-level response scale
- can be calculated either manually or via scoring software
- available in more than 50 languages
- can be administered either by an interviewer or self-administered
- requires 5 to 10 minutes to complete
- [www.SF-36.org](http://www.sf-36.org)

## Pediatric tests

- AMC (previously discussed)
- Unilateral Below Elbow Test (U-BET)
- University of New Brunswick Test of Prosthetic Function (UNB)
- Assistive Hand Assessment (AHA)
- Prosthetic Upper Extremity Functional Index (PUFI)
- ABILHAND-Kids
- Pediatric Orthopedic Data Collection Outcomes Instrument (PODCI)
- Pediatric QOL Inventory (PEDS-QL)
U-BET: BAGLEY ET AL

- Observational test
- Shriners Hospitals for Children UL amputee study
- Compared functional abilities, QOL of wearers and non-wearers
- designed to fill a gap in measurement of hand function capability of children and youth (ages 2 to 21 years) who have an amputation and do not wear a prosthesis.
- 9 bimanual tasks
- specific to developmentally-based age groups
- If the child is a prosthetic wearer, he performs the tasks in both the prosthesis on and off conditions, whereas non-wearers perform the tasks without a prosthesis.
- Ratings are done on two subscales
  - Completion of Tasks (5-point degree of difficulty-based scale)
  - Method of Use (4-point nominal scale)
- 20 minutes
- Administration guidelines can be obtained from the first author of the validation publication.

UNB

- well-known in clinical circles internationally
- first of the formal observational tests of function
- developed specifically for children (2-13 years of age) with a unilateral UL amputation
- designed for use within the prosthetic clinic
- measures the method of performance and spontaneity of prosthetic performance in children
- four age-based modules of developmentally appropriate bimanual tasks
- Method and spontaneity are each rated on 5-point scales
- Assumed that performance via active prosthesis use is superior to use as stabilizer*
- Scored from live performance
- 20 to 30 minutes to complete
- There is no specific training program for those administering the test
- available online www.unb.ca/biomed/unb_test_of_prosthetics_function.pdf
- Test kit can be built by the clinician according to the instructions in the manual
AHA: Krumlinde et al

- observational assessment
- designed in Sweden
- measures the effectiveness with which children with unilateral impairment use the affected hand along with the noninvolved hand in bimanual play activities
- Purpose: how the involved hand functions as an "assisting hand."
- Elicit spontaneous and natural performance of grasp, release, and manipulation skills during 12 to 14 fun-play activities.
- Designed for children with hemiplegic cerebral palsy or obstetric brachial plexus palsy ages 18 months to 12 years
- Rasch-built measure
- 22 actions that are
- Scored on a 4-point effectiveness of performance-rating scale
- 15 minutes to perform this play-based assessment
- Scoring is done from a video of the assessment
- Intensive 2.5-day training program that is required before a therapist uses the AHA
- Information on training, testing manual and materials kit is available at the developers' website www.ahanetwork.se

PUFI

- Functional status questionnaire
- Designed specifically for evaluation of children/teens who have unilateral UL amputation & prosthesis
- Evaluates a child's ability to perform bimanual activities with and without prosthesis
- Examines perceived usefulness of the prosthesis
- 2 versions:
  - young-child version (ages 3 to 6 years); 26 items; parent-report format,
  - older-child version (ages 7 to 18 years); 38 items; parent-report and child-report formats
- 4 separate response scales
  - method of performance: 6-point scale;
  - ability to perform with prosthesis: 4-point difficulty scale;
  - usefulness of prosthesis: 3-point scale; and
  - ability to perform without prosthesis: 4-point scale
- originated as a paper-report questionnaire, redesigned as a direct access software program
- 20 to 30 minutes to complete
- available in English, Dutch, Swedish, Slovenian and French
- free of charge from author by joining the PUFI database network
ABILHANDS-kids

- Functional status questionnaire
- Developed in France
- Assesses a child's ability to perform everyday manual activities
- Parent-report paper questionnaire that assesses the child's difficulty in performance as perceived by the child's parents
- Children 6 years of age and older
- 21 activities are mostly bimanual tasks
- Each task is rated on a 3-point degree of difficulty scale
- Rasch-measurement model, is a linear measure
- Scale was calibrated in children with CP aged 6 to 15 years
- 10 minutes to complete
- Available in French, English, and Dutch
- Assessment and scoring program can be accessed free of charge online through the ABILHAND website after registration
  www.rehab scales.org/abilhand-downloads.html

PODCI

- Generic questionnaire
- School-aged children/youth with musculoskeletal conditions
- Measure of ability to participate in normal daily activities and sports activities
- Brief measure of pain and overall health
- 3 versions:
  - Parent-report questionnaire (for use with parents of children up to 11 years of age),
  - Parent-report adolescent version,
  - Adolescent-report version
- 4 main functional scales (seven of the functional items are bimanual activities)
  - Basic mobility and transfers [11 items],
  - Sport and physical functioning [12 items],
  - UL and physical function [8 items], and
  - Pain/comfort [3 items]) and
- Additional items: pain/comfort, treatment expectations, happiness, and health satisfaction
- 4-point to 6-point degree of difficulty response scales
- 20 minutes to complete
- Questionnaires and scoring templates can be accessed without charge:
PEDS-QL

- Internationally-known questionnaire
- Evaluates HR-QOL of children
- 26-item generic version
- Consists of four multidimensional scales
  - (physical, emotional, school, and social function)
- Age-appropriate versions
- Child-report for those who are aged 5 years and above
- Available in multiple languages
- Internet version
- Has been used as a population health measure, for numerous diagnostic groups and in numerous cross-cultural validation projects
- Condition-specific modules for a number of disorders
- 5 minutes to complete
- There is a licensing fee that is based on the type of use; can be obtained online www.mapi-research.fr/t_03_serv_dist_Cduse_pedsql.htm

other

- Activities Measure-Upper Limb Amputee (AM-ULA)
  - Linda Resnik, PT, PhD
- Mental-Health Screening in Upper-Limb Outpatient Prosthetics Clinics
  - Tiffany A. Ryan, OTR, MOT
DEVELOPING A PLAN OF CARE

• What?
• When?
• Where?
• Why?
• How?

THE VISION: GOALS

• Client-centered
• Behavioral
• Objective
• Measureable

PHASES OF CARE

• Pre-prosthetic Readiness
• Prosthetic Training
• Refinement
COLLABORATING WITH THE PROSTHETIST

- Client-Centered
- Communication
- Consultation
- Plan of care
- Continuous

CONTRIBUTING TO MEDICAL NECESSITY

- Medical vs functional
- What is client using now?
- What is level of ability vs disability?
- What is being considered?
- What is being eliminated … and why?
- Bang for the buck: what is the most optimal/impactful yet least costly?
- Dot your i’s; cross your t’s
TIP Sheet

• Certified by the American Board for Certification (ABC)
• Minimum of five years of current UL experience and has fit >10 patients in the last year
• Can specify what types of electrically-powered prostheses they have fit in the past two years
• Received certification/training from the following prosthetic component manufacturers:
  – Motion Control:
  – Otto Bock:
  – RSLSteeper:
  – Touch Bionics:
  – Liberating Technologies:
  – Hosmer:
• Works with an OT who has extensive UL prosthetic rehabilitation experience
• Will arrange for you to speak with some of their patients to discuss care experience

TEAM APPROACH

Occupational Therapist
• Functional Evaluation
• Preparation for Prosthesis
• Client Education
• Adaptive Strategies
• Consultation to develop prosthetic prescription
• Prosthetic Training

Prosthetist
• Evaluation
• Client Education
• Consultation to develop prosthetic prescription
• Molding
• Fabrication
• Modification
## RESOURCES

<table>
<thead>
<tr>
<th>RESOURCES</th>
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<tbody>
<tr>
<td>Amputee Coalition:</td>
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</tr>
<tr>
<td>Amplitude:</td>
<td><a href="http://www.oandp.com">www.oandp.com</a></td>
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<tr>
<td>Amputee Empowerment Partners:</td>
<td><a href="http://www.empoweringamputees.org">www.empoweringamputees.org</a></td>
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<td>Association of Children’s Prosthetic and Orthotic Clinics:</td>
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</tr>
<tr>
<td>American Occupational Therapy Association:</td>
<td><a href="http://www.aota.org">www.aota.org</a></td>
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<tr>
<td>American Academy of Orthotics and Prosthetics:</td>
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- Evidence Note: Upper-Limb Prosthetic Outcome Measures; F. Virginia Wright, PT, PhD, Senior Scientist, Bloorview Research Institute; Chair in Pediatric Rehabilitation, Bloorview Children's Hospital Foundation; Associate Professor, Department of Rehabilitation Medicine, University of Toronto
REFERENCES

1. *Atlas of Amputations and Limb Deficiencies*, edited by Douglas G. Smith, MD, John W. Michael, MEEd, CPO, and John H. Bowker, MD (Specific chapters by Thomas Passero, CP, Kim Doolan, John R. Fisk, MD, and Douglas G. Smith, MD, Joan E. Edelstein, MA, PT, and Donald R. Cummings, CP, LP.


QUESTIONS

THANK YOU!