REHABILITATION OF THE UPPER LIMB AMPUTEES FROM ACUTE CARE TO THROUGH REHABILITATION
Objectives

• Develop basic understanding of the rehabilitation phases of amputee care
• Be able to describe options for upper limb prostheses
• Describe the benefits of multi-articulating hand terminal devices
# Etiology

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<th>PVD</th>
<th>Trauma</th>
<th>Tumor</th>
<th>Congenital</th>
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A team approach is of upmost importance for a person with an amputation to function in an able-bodied society. The team should be designed to meet the individual needs of the patient. As the patient progresses through the different stages of the rehabilitation process, the composition of the team will change as the needs of the amputee will also change.
Team Approach

- Patient and family
- Orthopedic Surgery
- Physical Medicine
- Occupational Therapy
- Physical Therapy
- Recreation Therapy
- Prosthetics and Orthotics
- Biomedical Engineering
- Nursing

- Case Management
- Social Work
- Religious Ministry
- Psychological Specialists
- Nutrition Care
- Administrative Support Team
- Anesthesiology
- Pain Management Team
Touch Bionics’ Philosophy

• Optimum patient outcomes are achieved when the Prosthetist and Therapist work closely together with the patient

• Early therapy nearly doubles the rate of daily use (Fletchall, 2005)

• New research suggests skilled, individualized therapy with the prosthesis takes an average of 20-30 hours (Resnik, et al., 2012)
Treatment- 3 Phase Program

• Phase I: Wound Healing and Preparation of Residual Limb
  - Wound care; Edema management/limb shaping; Exercises; Pain control (mirror therapy); Desensitization; Adaptive Equipment Training; Discuss Grieving in Limb Loss; Expectation Discussion (Peer Visitor)

• Phase II: Pre-Prosthetic Training
  - Change of Dominance Training (Challenge); Independent ADLs; Strengthening; Endurance; Balance; Scar Management

• Phase III: Prosthetic Training
  - Don/Doff; Prosthetic Care/Limb Care; Operation of Device; ADLs with Prostheses; Advanced Training
Nine Phases of Amputee Rehabilitation

1. Amputation with surgical reconstruction
2. Acute postoperative
3. Preprosthetic
4. Prosthetic prescription and fabrication
5. Prosthetic training
6. Preoperative
7. Community reintegration
8. Vocational rehabilitation
9. Functional follow up

R.H. Meier, III, M.D, and A. Esquenazi, M.D
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PHASE ONE
Phase I: Initial Management and Protective Healing

- ADLs
- Wound healing
- Edema Management
- Desensitization
- Scar Management
- Pain Control
- Exercise
- Evaluation

- Flexibility
- Gross motor tasks
- Psychological support
- Education
  - Grieving process
  - Prosthetic device options
  - Phantom Pain/Sensation
- Body Symmetry
ACUTE CARE

• Acute Care is a very important phase in the rehabilitation of the **Upper Limb Amputee**.

• The important components during this phase consist controlling pain, promote wound healing, maintain and or increase P/A ROM, specially for partial hands, increase upper limb, trunk, and reaming limb strength.

• Learning functional skills without the use of the prosthesis.
Wound Healing
Complications

- Wound infection
- Heterotrophic ossification
- Hypertrophic scar formation
- Contracture
- Tendon adhesion
- Bone deformity (malrotation)
- CRPS
- Painful neuroma
- Phantom Pain
Early Fitting Protocol
Pain Management

- Phantom Pain
  - Weight-bearing
  - Desensitization
  - Graded Motor Imagery/Mirror Therapy
  - TENS Unit
  - Using prosthesis
Edema Management
Desensitization

- Texture Bins
- Cotton balls
- Towels

- Massage
- Tapping/slapping
- Compression
Temporary Device
Shower Hand
Education and Managing Patient Expectations

To start the discussion it may be helpful to ask open questions such as:

- ‘Tell me what you understand of the product?’
- ‘How do you think the product will help you?’

These questions will allow you to manage patient expectations and address their understanding.

• An understanding of the patience, effort, time and training which is required to achieve the best from the prosthesis is essential. It can take several months for the patient to achieve confident and natural use of their prosthesis.
Types of Upper Limb Devices

- No Prosthesis
- Passive Functional or Non-Prehensile
- Body Powered
- Myoelectric or Externally Powered
- Hybrid
- Activity Specific
- Combination of Devices
Phase 2: Pre-prosthetic Training
Evaluation

- History: MOI, DOI, HD, prior level of function, psychosocial support information, goals, work/leisure interests, education, living situation
- Wounds/Incisions/ Skin grafts/Scars
- Additional injuries/medical conditions
- Shape of residual limb, edema

- Sensation
- Body Symmetry
- ROM of remaining joints
- MMT
- Phantom sensation/pain
- Residual limb pain
- Current ADL function
- Prehension and Dexterity sound side
OCCUPATIONAL THERAPY UPPER LIMB EVALUATION

Client Name: ____________________________________________________________________________
Date:________________________________________

History:

**Side of Limb Absence:** □ Right □ Left   **Hand Dominance:** □ Right □ Left   **DOB:** ___________

**Date of Limb Loss:** _____________________ or □ At Birth

**Level of Limb/Hand absence:** □ At Shoulder □ Transhumeral □ Transradial □ At wrist
□ Transcarpal
□ Palm only remains (5 digit absence) □ Partial Hand (Absent Digits): □ D1 □ D2 □ D3 □ D4 □ D5

What was the cause of your injury/ amputation?

□ Elective, 2° injury □ Elective, 2° congenital
□ Congenital □ 2° infection □ Agricultural accident □ Industrial accident
□ Car accident □ Frostbite □ Motorcycle accident
□ Diabetes □ Cancer □ Vascular disease
□ Act of violence □ Military duty related
□ Explosives □ Thermal burn □ Electrical burn □ Chemical burn
□ Other
**Prosthetic History:**

- **Previous Prosthesis:**
  - [ ] None
  - [ ] Body Powered (cable controlled)
  - [ ] Electric
  - [ ] Passive Hand
  - [ ] Activity Specific
  - [ ] Other________________________

- **Currently wears a prosthesis:**
  - [ ] Yes
  - [ ] No

- **If yes, how long has this prosthesis been used:**
  - Years ________ Months ________ (state approximate numbers)

- **Occupational Therapy to learn to use previous prosthesis:**
  - [ ] Yes
  - [ ] No

**Limb Condition:**

- **Location/Description of any Scar Tissue:**
  ____________________________________________________________

- **Sensation of Upper Limb/Hand:**
  - [ ] Normal
  - [ ] Diminished
  - [ ] Hypersensitive

- **Describe sensation:**
  ____________________________________________________________

- **Pain in Residual Limb:**
  - [ ] Yes
  - [ ] No

- **Type of Pain:**
  - Phantom
  - Pain (0 -10)__________
  - Residual Limb
  - Pain (0 -10)__________

- **Does this pain interfere with ability to wear a prosthesis:**
  - [ ] Yes
  - [ ] No

- **Pain in Sound Side:**
  - [ ] Yes
  - [ ] No
  - Pain (0 -10)__________

- **Overuse Pain in sound arm:**
  - [ ] Yes
  - [ ] No

- **Other related injury/disability:**
  - [ ] Brachial plexus injury
  - [ ] Head injury
  - [ ] Soft tissue injury
## Range of Motion/Strength and Control Site Testing:

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<th>Upper Limb</th>
<th>Right</th>
<th>Left</th>
<th>Notes</th>
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<td>STRENGTH</td>
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<td>SHOULDER</td>
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<td>Flexion</td>
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<td>Abduction</td>
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<td>Ulnar Dev.</td>
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<td>Digit Motion</td>
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<td>PIP</td>
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<td>Site 5:</td>
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Separation of Control? □ Yes □ No
Control of Prosthesis □ Myo □ FSR □ Other
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<tr>
<th>ADL Testing</th>
<th>IND</th>
<th>MOD-I</th>
<th>MIN-A</th>
<th>MOD-A</th>
<th>MAX-A</th>
<th>Notes: (w/device, comp motion, increased time)</th>
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<td>Feeding:</td>
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<td>Cut food with knife and fork</td>
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<td>Serve food into held plate</td>
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<td>Drink from glass/bottle</td>
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<td>Open bag of chips</td>
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<td>Able to bring food to mouth</td>
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<td>Toileting:</td>
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<td>Pull down/up undergarments/pants</td>
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<td>Able to wipe self</td>
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<td>Grooming:</td>
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<td>Floss teeth</td>
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<td>Brush teeth</td>
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<td>Shave (face, underarms, legs)</td>
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<td>Apply deodorant</td>
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<td>Blow dry/style hair</td>
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<td>Apply make up</td>
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<td>Nail care (cut/file/apply polish)</td>
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<td>Dressing:</td>
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<td>UE (Shirt/pullover/undergarment)</td>
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<td>LE (Pants/undergarment/socks)</td>
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<td>Latch &amp; zip jacket</td>
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<td>Button buttons/zip zipper</td>
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<td>Fasten/unfasten belt</td>
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<td>Tie shoelaces</td>
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<td>Bathing:</td>
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<td>Bathe upper/lower body</td>
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<td>Shampoo hair</td>
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<td>Wash opposite side of body</td>
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<td>Dry body</td>
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<td>Meal Preparation:</td>
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<td>Able to use stove/oven</td>
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<td>Peel/cut vegetables</td>
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<td>Mix/pour food into pan/bowl</td>
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<td>Retrieve items from cabinets/fridge</td>
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<td>Open jar and/or container</td>
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<td>Housework:</td>
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<td>Sweep, vacuum &amp;/or mop floors</td>
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<td>Use dust pan with broom</td>
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<td>Do laundry (fold/hang)</td>
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<td>Make bed</td>
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<td>Grocery shopping/carry bags</td>
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<td>Take out garbage</td>
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<td>Do the dishes</td>
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<td>Iron</td>
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<td>Mow the yard</td>
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<td>Rake or Shovel</td>
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<td>Garden</td>
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<td>Home Repairs</td>
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<td>Drive a Car/Truck</td>
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<td>Hold wallet &amp; remove money</td>
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<td>Fish</td>
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<td>Hunt</td>
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<td>Golf</td>
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<td>Ride a bike</td>
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<td>Paint</td>
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<td>Swim</td>
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<td>Volunteer</td>
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<td>Ball games (Baseball, Soccer, etc.)</td>
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<td>Play a musical instrument</td>
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<td>Woodwork</td>
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<td>Work out</td>
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<tr>
<td>Run</td>
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<tr>
<td>Boat</td>
<td>Video games</td>
<td>Ride a motorcycle</td>
<td>Board games</td>
<td>Other: __________________</td>
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**Short Term Goals**

1.  
2.  
3.  

**Long Term Goals**

1.  
2.  
3.  

**Summary of ADL/IADL’s:**

________________________________________________________________________________

_______________________________________________________________________________

_____________________________________________________________________________________________________

Psychological/Cognitive Status requires further assessment?  □Yes  □No

Client/Family participated in goal development  □Yes

Limiting factor(s) in goal achievement___________________________________________
Plan of Care:
Eval Notes:

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Therapist Signature/Credentials

Date
Pre-prosthetic Training

• Myosite testing and training
• Realistic expectations for prosthesis function
• Change in Hand Dominance
• Strengthening
• ADLs /IADLs
virtu-limb

- Simulation and training product
- Provides biofeedback
Targeted Nerve Reinnervation

Pre-Op
1 available control signal

Post Op
4 available control signals
Targeted Nerve Reinnervation
Terminal Devices
Activity-Specific Prostheses/Terminal Devices

- Fishing
- Hunting
- Sports
- Hobbies
- Musical Instruments
- Weight lifting
Body Symmetry

- Walking
- Sitting
- ADLs in front of mirror
- Group fitness classes
Potential Adaptive Equipment Recommendations
Terminal Devices
Phase 3: Prosthetic Training
Prosthetic training

Do to high technology in the development of myo electric prosthesis, prosthetic training may begin during the fabrication of the diagnostic prosthesis.
While on the diagnostic phase of fabrication, adjustment can be made if necessary to assure proper fitting and proficient use and control of the prosthesis.
Basic Prosthetic Training

- After receiving prosthesis
- Don/Doff device
- Prosthesis control, proportional control
- Increase Independence
- Care for device/residual limb
- Grading activity
- Increase wear tolerance (30 min – 1 hour 2-3x/day, and increase as tolerated)
Prosthetic Training

- The first task to cover will be the donning and doffing of the prosthesis.
- At the beginning the patient should wear the prosthesis for short periods of time several times a day.
Functional Therapy Training Considerations

• Sufficient rest periods are required
• Fatigue will result in poor signal control and be counter productive
• Training task complexity will depend on patient ability and confidence
• Start with **simple unilateral** tasks
• Focus on **Approach, grasp & release** of various items
• Vary height and position of arm to ensure the patient can control the arm in various positions
• **i-limb Hand and Digits** will respond in relation to the strength of signal given by the patient

• This provides the hand with proportional control, therefore a patient can pick up a light object such as a plastic cup without crushing it
Functional Therapy Training – Proportional Control

- **i-limb** devices will respond in relation to the strength of signal given by the client
- This provides the **i-limb** with proportional control, therefore a client can pick up a delicate object such as a plastic cup without crushing it
Example Use of Utensils
Example ADL tasks
Example Use of Utensils
Functional Therapy Training
Intermediate Training

- Emphasis is on the value of the prosthesis as a functional assist and bilateral tasks can be commenced such as:
  - Using cutlery to cut food
  - Pouring liquid into a cup
  - Taking money and cards out of wallet
  - Using a hairdryer and brush to style hair
i-digits: Definitive Prostheses

- Perform all previous ADL tasks
- Less verbal cueing
• Once the patient is competent with basic training they can progress to **intermediate training**
• Emphasis is on the value of the prosthesis as a functional assist and bilateral tasks can be commenced e.g.
  - Using cutlery to cut food
  - Pouring liquid into a cup
  - Taking money and cards out of wallet
  - Using a hairdryer and brush to style hair
Functional Therapy Training
Intermediate Training continued

• Progress from simple bilateral tasks to more complex bilateral tasks such as preparing a meal and dressing
• Always incorporate the patient’s short-term and long-term goals determined at the initial assessment
• Include tasks useful for the patient’s employment, hobbies and lifestyle
• Intermediate training should build the patient’s skills and confidence so that they can continue to develop independently in their own environment
Intermediate Training-
Incorporating grips
i-limb digits: Definitive Prostheses

- Perform all previous ADL tasks
- Less verbal cueing
Example ADL tasks
Age appropriate tasks
Functional Therapy Training
Intermediate Training Continued

- Progress from simple to more complex bilateral tasks such as preparing a meal and dressing
- Begin utilizing grips
- Focus on client’s short-term and long-term goals
- Include tasks useful for the client’s employment, hobbies and lifestyle
- Intermediate training should build the client’s skills and confidence
Phase 4:
Advance Prosthetic Training
Advanced Prosthetic Training

- Individualized Training
- Use of preferred device
- Driver’s Training
- Recreation/Sports
- Vocational Reintegration
Community Re-integration
Phase IV: Advanced Prosthetic Training
Vocational Rehabilitation
Community Re-integration
Community Re-integration
Follow-up

- Follow up is crucial to ensure the best functional and emotional outcomes have been maintained. This follow up should include all members of the team if possible.
- There is a high incidence of poor upper extremity wearing and use in the unilateral amputee. The factors that influence this pattern are:
  1. Unilateral amputee can perform most of their ADL and work activities with their normal arm and residual arm.
  2. Prosthesis is too heavy.
  3. Do not provide good cosmetic restoration.
  4. Discomfort
- The major factor is comfort
Children with upper extremity amputations or congenital limb deficiencies also require a team approach. We need to remember that children are not “

**miniature adults**”. Their needs are constantly changing. These changes are caused by development and growth. The team must be composed of multidisciplinary members experienced and knowledgeable in dealing with children and their growth and development process.

Do to the complexity of this population the topic of the pediatric rehabilitation process needs to be discussed in another presentation.
Questions?
WE IMPROVE PEOPLE’S MOBILITY
References Continued


References Continued


