Rehabilitation of the Amputee

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Etiology/Incidence
Incidence of Amputation

- In 2005, 1.6 million Americans living with lost limb, to increase to 3.6 million by 2050 due to obesity, diabetes, and dysvascular disease (Sawers, 2013)
- 94% of amputations are in the lower extremity (Sawers, 2013)
- Those related to vascular disease, 2/3 had diabetes mellitus (Glaser, 2013)
- Rates of contralateral amputation are highest in diabetics (over 50%) and also predicted by renal disease, artherosclerosis and atherosclerosis with diabetic neuropathy (Glaser, 2013)

Incidence of Amputation

- 25% lifetime risk
- Forecast to double number of DM pts in next two decades (44.4 million by 2034)
- 52% reamputation rate of those with toe amputation
- 13% for more proximal amputations

Trends/Research

- Latest results of types of amputations show:
  - Transmet increased by 23.9%
  - Transtibial increased by 10.3%
  - Transfemoral decreased by 42%

- Comorbidities include
  - 70% HTN
  - 49% high cholesterol
  - 22% CAD
  - 16% Diabetes
  - Undiagnosed diabetes 27.8%

Belatti, 2013
Trends/Research

- Cognitive impairment appears to be more prevalent among patients with LE amputations than the general population. Cognitive impairment is negatively associated with mobility/prosthetic use. Need to screen to assist with potential success as a prosthetic wearer.

Coffey, 2014

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Trends/Research

- Transfemoral ambulators compared to transtibial ambulators
  - Household ambulation: 50% TFA compared to 66% TTA
  - Community ambulation: 29% TFA compared to 54% TTA

Sawers, 2013

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Etiology of LE Amputation

- Trauma
- Infection
- Vascular
- Congenital
- Tumor
Levels of amputation and issues affecting success

Levels of Amputation “LINGO”
- Partial Foot
- Syme’s
- Below knee (BKA or transtibial)
- Above knee (AKA or transfemoral)
- Knee disarticulation
- Hip disarticulation

Issues impacting success
- Pain
- Skin integrity
- Co-morbidities
- ROM/contractures
- Self continuation
- Cognition/Family availability for training
- Funding
- Falls/decreased confidence level
- Heterotopic ossification
- UE involvement
- Time since use of amputated limb
- Previous contralateral amputations or time between amputation and fitting
PreProsthetic Intervention

Immediate Post Op Care

- Edema control
- Wound care
- Pain management
- Positioning/range of motion
- Mobilization of client
- Strength and endurance
- Prosthetic readiness
- Equipment

Edema control

- Surgeon dependent
- A number of alternatives used:
  - elevation
  - post op casts (rigid dressings)
  - post op splints (prefab items)
  - compression stockings
  - ace wraps
Wound care

- Healing will affect the success in prosthetic fitting and timing for fitting
- Diabetes may affect speed of recovery
- Use of wound vabs may be used to help with healing
- Possible need for additional surgeries may prolong prosthetic fitting timeframe
Phantom pain in the literature reported anywhere from 42.2% to 78.8% of the population (Subedi 2011)

Described as cramping, burning, tingling, sharp, shooting, electrical, sticking, squeezing, knifelike

Pharmacotherapy – Neurontin (gabapentin) and Lyrica, maybe amitriptyline

Relaxation

Physical modalities; TENS

Mirror therapy

Desensitization

Acupuncture
Positioning/ROM

- Preserve ROM at knees and hips for all planes
- Suggest prone lying for all who can, both now and for future
- Education of family/parents/caregiver

Strength, endurance, mobility

- Foundation for prosthetic use
- Sound limb becomes the dominant limb but it may be less than perfect
- Balance on sound limb to assist with don/doffing
- Mobility: sit to stands, transfers, bed mobility, wc mobility
- Core stability
- Challenge of non-weight bearing status to younger kids/toddlers. Involvement of family for education

Prosthetic readiness

To be a prosthetic candidate, one MUST consider:
- transfer independently or modified independently
- rise from sit to stand independently or modified independently
- gait with one leg is nice but not an absolute especially dependent on condition of sound limb
Prosthetic readiness

- Physician will determine readiness for prosthetic fitting. Usually dependent on skin integrity.

- When leaving acute care or rehab, the patient or family member MUST have a HEP to address strength, endurance and ROM.

Education

- Strength and ROM education/home program

- Education on co-morbidities
  - Smoking/tobacco usage
  - Diabetes and sugar control
  - Blood pressure checks
  - Neuropathy and assure skin checks on sound side as well as appropriate shoe wear.

Pre-prosthetic measures

- Pre prosthetic
  - AMPnoPRO (Gailey 2002)
    - Sitting/standing balance
    - Sitting/standing reach
    - Transfers
    - Sit to stand and return
    - Nudge test
    - Standing eyes open and closed balance
    - Picking objects off floor
    - Gait activities
Equipment

- Wheelchair, with stump support if transtibial
- Assistive device for ambulation
- Reacher
- Elevated toilet seat
- Tub bench or chair
- Slideboard if needed
- Wound care supplies if needed

Componetry

NOTE: This information is relevant only to Medicare patients. Your physician, in consultation with your prosthetist, will decide on the type of prosthetic components (socket design, foot type, etc.) to be used in your prosthesis. During this process they will try to predict the activity (functional) level you're most likely to achieve in order to choose the most appropriate components for your prosthesis.

K levels

NOTE: This information is relevant only to Medicare patients. Your physician, in consultation with your prosthetist, will decide on the type of prosthetic components (socket design, foot type, etc.) to be used in your prosthesis. During this process they will try to predict the activity (functional) level you're most likely to achieve in order to choose the most appropriate components for your prosthesis.
K levels 0 - 2

- **Functional level 0**: The patient does not have the ability or potential to ambulate or transfer safely with or without assistance and a prosthesis does not enhance his/her quality of life or mobility.
- **Functional level 1**: The patient has the ability or potential to use a prosthesis for transfers or ambulation on level surfaces at fixed cadence. Typical of the limited and unlimited household ambulator.
- **Functional level 2**: The patient has the ability or potential for ambulation with the ability to traverse low level environmental barriers such as curbs, stairs, or uneven surfaces. Typical of the limited community ambulator.

K levels 3 - 4

- **Functional level 3**: The patient has the ability or potential for ambulation with variable cadence. Typical of the community ambulator who has the ability to traverse most environmental barriers and may have vocational, therapeutic, or exercise activity that demands prosthetic utilization beyond simple locomotion.
- **Functional level 4**: The patient has the ability or potential for prosthetic ambulation that exceeds basic ambulation skills, exhibiting high impact, stress, or energy levels. Typical of the prosthetic demands of the child, active adult, or athlete.

**Determinations of componentry**

- Anatomy
- Function
- Skin integrity
- Shape
- Dexterity
- Occupation
- Recreational activities
Concerns in fitting

- Bony prominences/invaginations
- Skin mobility/integrity/sensitivity
- Sensation/pain
- UE involvement/fine motor
- Length of limb
- ROM limitations

Suspension

- Suction
- Locking gel liner with pin or lanyard
- Sleeve suspension
- Vacuum

Interface options

- Gel liners
- Socks
Vacuum suspension

Prosthetic feet

<table>
<thead>
<tr>
<th>K1</th>
<th>K2</th>
<th>K3/K4</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>S.A.C.H.</td>
<td>Flexible Keel</td>
<td>Dynamic Response Hybrid: Dynamic Response w/ multi-axis</td>
<td>Specialty</td>
</tr>
<tr>
<td>Single-Axis (Transfem. Level)</td>
<td>Multiple-Axis Hybrid: Elastic keel w/ Multi axis</td>
<td>Dynamic Response w/ adjustable ankle</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Dynamic Response w/ hydraulic single axis</td>
<td></td>
</tr>
</tbody>
</table>

Transfemoral knee components

- Single axis
- Polycentric
- Stance control (Safety Knee)
- Manual locking
- Microprocessor
Post Prosthetic Evaluation

Evaluation components

- Subjective history
- Subjective/objective outcome measures
- ROM
- Strength
- Sensation
- Skin integrity/girth including sound limb
- Prosthetic management

Evaluation components

- Gait
- Balance/weight acceptance and tolerance
- Home program
- Education – creating written instructions
**Important subjective history**

- Are they managing their co-morbid diagnoses (sugars, blood pressure, ejection fraction, wt gain for CHF)? Make sure to get the values
- Are they on dialysis? Which days do they attend?
- Who is with them at home during the day and can assist?
- How long has it been since they have been “walking” well?
- What equipment do they own?

**Amputee subjective measures**

- AALQ: Attitude to Artificial Limb Questionnaire
- AAS: Amputee Activity Score
- ABC: Activities-specific Balance Confidence Scale
- ARBIS: Amputation Related Body Image Scale
- BIQ: Body Image Questionnaire
- FAI: Frenchay Activities Index
- Functional Measure for Amputees (FMA)
- Houghton Scale
- Locomotor Capabilities Index (LCI) subscale within the PPA
- Prosthetic Profile of Amputee (PPA)
- Prosthetic Limb Users Survey of Mobility (PLUS-M)
- OPCS: Office of Population Consensus and Surveys Scale
- OPOOT: Orthotics and Prosthetics National Outcome Tool
- PEQ: Prosthetic Evaluation Questionnaire
- PPT: Physical Performance Test
- PSSS: Perceived Social Stigma Scale
- RMI: Rivermead Mobility Index
- Russek’s Code
- SF-36, Short form 36, Short Form 12
- SIP: Sickness Impact Profile
- TAPES: Trinity Amputation and Prosthesis Experience Scales
- Others used not specific for amputees could be
  - Oswestry Pain Disability Scale
  - LEFS
  - WOMAC
Houghton Scale

1. Do you wear your prosthesis?
   1 = 24 hours
   2 = 8 hours
   3 = greater than 8

2. Do you use your prosthesis to walk?
   1 = Just walking in the house or prostatical
   2 = Outside the home occasionally
   3 = Walk and outside all the time

3. When going outside wearing your prosthesis?
   1 = Use two crutches, two canes, or a walker
   2 = Use one cane

4. When walking with your prosthesis outside, do you feel unstable when:
   Walking on a flat surface
   1 = yes
   2 = no
   Walking on slopes
   1 = yes
   2 = no
   Walking on rough ground

Locomotor Capabilities Index

Table 1. The Locomotor Index

<table>
<thead>
<tr>
<th>ROM/strength</th>
</tr>
</thead>
<tbody>
<tr>
<td>TTA:</td>
</tr>
<tr>
<td>hip flexor contractures, hamstring contractures</td>
</tr>
<tr>
<td>TTF:</td>
</tr>
<tr>
<td>hip flexor contractures, ER contracture, adductor contractures, decreased pelvic mobility</td>
</tr>
<tr>
<td>TTA:</td>
</tr>
<tr>
<td>all hip musculature (focus is on hip extensors and abductors); quad strength especially terminal extension</td>
</tr>
<tr>
<td>TTF:</td>
</tr>
<tr>
<td>all hip musculature (focus is on hip extensors, abductors and adductors)</td>
</tr>
</tbody>
</table>
Sensation

- Test light touch of sound limb and amputated limb
- Test proprioception of sound limb and most distal joint intact on amputated side
- Utilize reflex hammer as part of treatment and hit at the toe and heel of the prosthetic foot to get the patient to understand the feeling of where the heel and toe are to assist especially with unlevel surfaces
Skin integrity and girth

- Measure girth
  - To monitor changes; can write a goal if needed
- Assess for open areas
  - Measure and document; write goal if needed
  - Determine cause of skin issue (wound, folliculitis, fungal)
  - Will it affect using prosthesis? Clinical decision/contact MD

Determination for holding therapy/out of prosthesis

- Questions to ask to determine course of action
  - Is wound going to worsen with weightbearing activities?
  - Are there visit limits or cap limits?
  - Is the patient providing good carryover with HEP?
  - Is the patient going to heed your instructions?
  - Is the liner or shrinker going to worsen the wound?
  - How will you as a therapist monitor wound and determine when to begin therapy again?

Prosthetic Mgmt - prosthesis

- Name and number of prosthetist and next visit date
- What has their prosthetist told them to do regarding the prosthesis
- Denote type of suspension
- Denote type of compometry for ankle and knee
- For transfemoral knee, how does compometry work and what makes it unstable
Prosthetic Mgmt – wear and skin

- Determine amount of assist to don/doff prosthesis either patient for family member
- How long is patient wearing prosthesis including sitting and walking time?
- Is patient independent with skin checks in all areas?

Education: wearing time

- Start from prosthesist instructions
- Use more than 1x a day wear time
- Go up every 2-3 days with good tolerance
- Educate difference of walk time and wear time
- Wear time may change due to noncompliance and fragile skin

Education: skin checks

<table>
<thead>
<tr>
<th>Transfemoral</th>
<th>Transtibial</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check distal end for end bearing/verucus</td>
<td>Check distal end for end bearing/verucus</td>
</tr>
<tr>
<td>Check groin, ischium for abnormal weightbearing</td>
<td>Check inferior patellar pole, fibular head, tibial tuberosity, distal end of tibia</td>
</tr>
<tr>
<td>Make sure they are not flexed at hip creating more issues at the groin</td>
<td>Prosthetist may need to adjust socket to allow for decreased pressure</td>
</tr>
<tr>
<td>If improper sock fit, can be going too far down into socket and causing pressure on the groin</td>
<td></td>
</tr>
</tbody>
</table>
Prosthetic Mgmt - socks

- Can patient explain when and why a sock needs to be added or taken away?
- Does patient know ply versus socks?
- Where patient cannot do these – can a family member or caregiver answer these questions?
Education: sock management

- Look for end bearing pressure
- Look for feeling of “hitting” socket with distal end of bone
- Look for rotation of socket with continued walking
- Ask about groin pressure with TFA clients

Things for the clinic

- Use of silicone to test end bearing/sock fit
- Alcohol based products for putting on liners for suction suspension
- Telfa/bandaids to assist with covering wounds/skin compromise
- Extra socks
- Have client/family member sign photograph consent. Check your facility for appropriate form
Objective performance measures

- 2 minute walk test or 6 minute depending on activity level (Timed walking tests)
- TUG
- FSST/ Four Square Step Test
- L test
- AMPPro (for unilateral and bilateral amputees)
- Functional reach
- CHAMP
- Pedi-CHAMP
Balance

- Observe sit to stand for weight acceptance/weight bearing
- Assess static standing balance with and without UE support and on firm/compliant surfaces
- Perform balance performance measure – Berg or AMPPro balance sections
- Record Balance Master testing if available

Weight acceptance and tolerance

- Assess weight acceptance/tolerance in // bars first or stable surface (counter) if no // bars
- Begin with 2 UE; then same UE; if too difficult, then opposite UE
- Assess deviations/pain/avoidance/fear
- Using step touch (8” step)
  - May use lower step if fear a factor – at least for assessment purposes and progress to 8” step

Home program

- Strengthening program, closed chain and core
- Stretching program
- Walking program; ask for amount of time walking currently for use as a goal
- Wearing time/schedule
- Skin checks
- Amputee handout – puts things down on paper what was told verbally
### Patient Ed - focus of therapy

- Increase strength
- Decrease wheelchair usage/type of device
- Increase distance of ambulation (determine household ambulator versus community ambulator) and progression of device; decrease deviations; increase confidence
- Assure independence with prosthetic management including sock management/skin management and don/doffing of prosthesis
- Promote self continuance
- Guidance along the journey

### General issues that can arise

- All the following may interrupt original POC:
  - Poor fit in prosthesis or cannot fit in prosthesis
  - Skin integrity breakdown/potential breakdown/hygiene of skin/liners
  - Integrity of sound limb
  - Pain
  - Fall
  - Poor carryover or attendance

### Assessment, Goals, Timeframes

- **Goals**
  - Gait, ROM, advanced gait, outcome measures, HEP, wear time, don/doff, sock management, skin integrity
- **Assessment**
  - Look at external issues which might affect success as a prosthetic wearer, including family support and cognition
- **Timeframes to see patient**
  - Can depend on insurance type and visit limits
  - Can depend on skin integrity or tolerance
  - Can depend on time to progress device/progression time
  - Can depend if patient lives in your city/country
Gait Analysis

Amputee gait analysis

- Perform analysis in frontal and sagittal planes
- Remember with normal gait – looking at the normal pattern of symmetry. For the unilateral amputee, deviations are often identified by observing asymmetry of the prosthetic side and the sound side
- Sound side does not always depict “normal gait”
- Bilaterals – there is not a normal side, fall outside the box and will talk about them specifically later

Things affecting gait success

- Decreased balance
- Increased energy expenditure
- Decreased walking speed
- Gait asymmetry
- Increased falls and stumbles
- Increased difficulty with unlevel surfaces
- Increased cognitive demand
Gait Deviations

Transtibial Gait Analysis

- Deviations During Swing
  - Decreased knee flexion
  - Toe drag
  - Lateral bending away from prosthesis
  - Decreased step length
  - Medial or lateral whip

- Deviations During Stance
  - Foot slap
  - Rotation of foot
  - Excessive knee flexion
  - Knee hyperextension
  - Lateral trunk lean toward prosthesis
  - Varus/valgus at knee
  - Abducted gait
  - Decreased stance time/opposite side decreased step length
  - Increased lumbar lordosis
  - Reduced arm swing and trunk rotation
  - Forward trunk lean

Transfemoral Gait Analysis

- Deviations During Swing
  - Decreased prosthesis knee flexion
  - Increased toe drag
  - Lateral trunk bending away from prosthesis
  - Increased knee flexion or excessive heel rise
  - Medial or lateral whip
  - Vaulting
  - Decreased step length with prosthesis
  - Increased time waiting on heel contact of prosthesis

- Deviations During Stance
  - Foot slap
  - Rotation of foot
  - Knee instability or buckling
  - Lateral trunk lean toward prosthesis
  - Abducted gait
  - Decreased stance time/decreased step length on opposite limb
  - Increased lumbar lordosis
  - Reduced arm swing and trunk rotation
  - Forward trunk lean
### Prosthetic vs patient causes

- This at times is difficult to distinguish which comes first, but always try and fix the patient causes before accommodating the prosthesis to fix a deviation.
- Many of the deviations are related to fear/pain and decreased weight bearing/weight acceptance.
- Many are related to fit of the prosthesis such as don/doffing process or wearing the proper number of socks.

### Important things to remember

- Need to know how and what makes the knee buckle during stance.
- Will depend on what type of knee componentry they have (if you don’t know – ask your prosthetist).
- Practice what the knee does in a protected environment.
- How you train a MPK is different with an NMPK due to the resistance provided during stance flexion (going down ramps).

### Prosthetic collaboration

- Success is dependent on the collaboration of the patient through education/buy in, the therapist and the prosthetist.
- If possible, have the prosthetist come to you during a patient treatment and build relationships/problem solve together to do what is best for the patient/client.
Get to know your prosthetist and know how to talk with them.

VIDEOS on gait

VIDEO #1 – AKA RW GAIT
VIDEO #2 – AKA GAIT STC

Therapy Interventions
Treatment ideas

- Strengthening/contracture management
- Balance/proprioception
- Weight acceptance/weight bearing
- Progression of device/gait distance/gait deviations
- Functional activities
- Leisure activities

Strengthening/Contractures

- Use of exercises
  - Closed versus open chain
  - Speed of contraction changes
  - Learn how to control knee (hip flexors to bend, hip extensors to extend without substitution in lumbar spine)
  - Core strengthening, use of rhythmic stabilization

- Use of cardio equipment
  - Watch skin closely – more force on distal end of femur anterior and posterior due to pulling up and pushing down with TFA; more force on distal end of tibia due to quad usage and forced into socket with TTA
  - Getting on and off device

Core/speed of contraction

- Use of body blades/balls/rhythmic stabilization
- Changing speed of movement and direction
- Use of tennis ball under sound side
- Standing on compliant surfaces
- Pilates 100’s
Balance/proprioception

- Stepping over obstacles
- Starts/stops
- Touching boxes
- Kicking boxes
- Narrow base of support (with head turns, arm movements)
- Arm swing with use of weights, theraband and poles
- Changing step length

Balance/proprioception

- Target stepping (clock face)
- Stepping over hold and step back
- Pushing/pulling with theraband or cable machine
- All activities mentioned on compliant surfaces
- RS UE/hips/knees
  - Straight plane, diagonals, increasing speed
  - Perform on compliant surfaces

Balance/proprioception

- Multi-tasking/dual tasking/divided attention
- Obstacle courses – can time them to show improvement
- Rocker boards (watch knees and how they unbuckle)
- Balance Master as options for speed and limits of stability
Weight acceptance/bearing

- Work on pt getting “over the leg” and not resting on the heel of prosthesis with hip flexed (usually due to fear of knee buckling or weak extensors)
- Use verbal cues such as “smashing the bug” with their toe
- Resistance at hip to allow patient to engage hip extensors during stance on prosthetic side. This is especially important for stability for transfemoral amputees and usually fixes a lot of the issue with decreased pelvic rotation

Weight acceptance/bearing

- Single limb stability (many of balance exercises previously); forced use activities use 6 inch step to assist with step touches; go down in height only if needed for safety or success of performing the activity
- Step touches/target stepping/progression of UE support as needed (2UE, 1UE, dynamic UE, 0UE)
- Step ups/downs
- Encourage hip extensor strength/firing with activities
- Longer stride during gait with sound limb

Trunk rotation/arm swing

- Use of NDT poles in “free arm” to assist with getting arm swing
- Have them “relax” their arms to promote unconscious swing of UE
- Tactile cues in the // bars to promote trunk rotation
- Hip resistance will assist with trunk rotation
Progression of gait/distances

- Walking program for distance
- Changing directions/changing speed and adding both together
- Work on trying to change/treat deviations seen during gait analysis

Progression of gait device

- What devices are used in the clinic?
  - Rolling walkers
  - Unilateral devices
  - NDT poles
  - Strong arm canes
  - Walls
  - Corners

Progression of gait device

- What are the factors affecting your timeframe of device progression?
  - Tolerance
  - Pain
  - Skin integrity
  - Patient compliance
  - Patient confidence
  - Fall risk
Progression of gait device

- Does confidence play a role and can the therapist influence it?
  - Do you use harnesses in therapy?
  - Give easy and hard exercises, but always end on easier to boost confidence
  - Time increases confidence, practice, practice, practice
  - Falls always affect confidence somewhat, try to see why they fell and address the why. They will fall sometime and educate them on getting up from the floor early
  - Show them they can be successful, it will boost their confidence

Functional activities

- Carrying objects
- Bending/stooping/reaching
- Learning how to unlock knee to sit, “ride” knee down for ramps and stairs
- Outside surfaces/grass
- Functional play for kids in play areas or on playgrounds

Functional activities

- Getting in and out of the car
- Getting off of the floor
  - Multiple techniques for TFA
- Stairs/curbs/ramps
  - Depends on strength of limb and mobility of foot/knee
  - Strategies for foot over foot (TTA versus TFA)
  - Progress with decreased UE usage
Leisure activities

- Gym activities
- Treadmill
- Running
- Golf
- Swimming
- Assuring resources for adaptive sports activities

Clinic items for treatment

- Steps, foam, balls, bolsters, boxes, discs, rocker boards, inflatables
- Area to perform objective/performance measures marked off (distances for L test, TUG, 2/6 minute walks)
- BP/pulse oximeter for vitals
- Various heights of chairs including ones with wheels
- Alternative assistive devices/gait belts/parallel bars if possible
- Cardio equipment, Balance Master if able

VIDEOS treatment activities

- VIDEO #3 – AKA UP FROM FLOOR
- VIDEO #4 – TRAINING FOR BKA
Special Considerations for Bilateral Amputees, Knee Disarticulations and Quad Amputees

- Need to find their sense of balance
- Tends to stay forward on feet with knees slightly flexed
- Do they need lots of UE support?
- Work on fall strategies and up from floor

Bilaterals – TFA or TTA

<table>
<thead>
<tr>
<th>TTA</th>
<th>TFA</th>
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<tbody>
<tr>
<td>- Need to find their sense of balance</td>
<td></td>
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<td>- Tends to stay forward on feet with knees slightly flexed</td>
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<td>- Do they need lots of UE support?</td>
<td></td>
</tr>
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<td>- Work on fall strategies and up from floor</td>
<td></td>
</tr>
<tr>
<td>- Need to find their sense of balance</td>
<td></td>
</tr>
<tr>
<td>- Usually start in stubbies and low center of gravity</td>
<td></td>
</tr>
<tr>
<td>- Can move to height and then look at locking knees or microprocessors</td>
<td></td>
</tr>
<tr>
<td>- Need to be ok with falling</td>
<td></td>
</tr>
<tr>
<td>- Do they need lots of UE support?</td>
<td></td>
</tr>
<tr>
<td>- Sit/stand difficulty depending on height of prostheses</td>
<td></td>
</tr>
<tr>
<td>- Work on fall strategies and up from floor</td>
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</tbody>
</table>

Case Study: Stubbies versus Bilateral C legs

- Article written in 2010 by Carson
- A female patient who could effectively ambulate with stubbies and bilateral C leg prostheses should improved outcomes with stubbies versus C-legs
- The Physiologic Cost Index (looks at heart rate), ABC-16 (looks at self perceived balance confidence), and Canadian Occupational Performance Measure (COPM – prioritizes most meaningful functional needs of an individual) were used as measurements
Findings of Case Study

- HR with stubbies (96.33 with peak 110)
- HR with C legs (110 with 143 peak)
- ABC 84.33 with stubbies
- ABC 43.33 with C legs
- COPM 8 (range 1-10) with stubbies
- COPM 3.8 with C legs

Pt chooses to use stubbies at home even though she is able to consistently walk on challenging terrain with C legs without loss of balance. When asked why she feels she is more balanced on stubbies states lower height and lack of articulating knees that rarely buckle.

Special considerations for treatment of quad amputees

- Use of balance activities to increase stability
- Challenge of using devices (platform walkers or push tables due to UE needs)
- Functional movements and observation

Knee Disarticulation

- Different knee center – cosmesis
- Lots of surface area – improved control of knee due to lever arms
- Most muscles at hip are intact with origin and insertion except for those that cross the knee
Videos of bilaterals/quads

VIDEO #5 – BILATERAL BKA

Remember resources

- Develop peer mentor program
- Adaptive sports
- National organizations
- Local organizations
- National prosthetic companies
- National vendors of components

Thank you so much!!

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