Getting “handy”
Techniques for Maximizing Arm and Hand Function After SCI

Amy Cisler  acisler@uw.edu
Beth Gardner  bgardner@uw.edu
Leslie Fox  foxl@uw.edu

http://sci.washington.edu/upperlimb
Thank you to

• Occupational Therapists at Harborview Medical Center

• SCI consumers who have shared ideas/experiences

• Teresa Foy- Shepherd Center

• Gail Raymond- Craig Hospital
Why we wanted to talk about UE function after tetraplegia

• Arm and hand function is reported to be the most debilitating and hard to deal with losses

• Arm and hand function: top priority area for continued research

• Functional use of hands increases independence and decreases caregiver need
Objectives

• Understand compensatory techniques and options to increase independence with self care
• Gain an understanding of frequently used treatment options
• Summary of current research
• Review options for exercise
C4 Complete injuries

Due to the high level of injury, many compensatory strategies that we are going over will not work for people with this level of complete injury

— Assistive technology is a primary focus for phone, computer access and environmental control

— Hiring caregivers will also be of primary concern
Resources for People with C4 complete level of injury

• Phone and computer access presentation
  – Phone & Computer Access for People with Limited Arm and Hand Function

• Hiring caregivers presentation
  – Personal Caregivers: Tips, Tricks and Tales from Individuals with Spinal Cord Injury
Options for UE rehabilitation

- Adaptive equipment and tools
- Splints
- Exercise: strengthening and ROM
- Functional Electrical Stimulation
- Tendon transfers
Eating and Drinking

Dining with dignity utensils- worn on thumb and forefingers

www.diningwithdignity.com

Fork inserted into a universal cuff
Utensils with built up handles

Can be angled or positioned in any direction to fit users grip/hand function
Lightweight rocker knife with upright handle

Pizza cutter with large handle – could be built up more
Rocker knife for cutting food. Use with two hands and tenodesis or adapted with a custom cuff for one‐handed use.
Drinking

Camelbak tubing mounted on Loc-Line

Tubing clipped to shirt with badge clip for easy access
Cable/Zip ties used to create loop for hooking water bottle

Commercially available drink holder with non-skid surface on interior of strap. U-drink holder from u-adapt.com
Metal water bottle adapted with long tubing and Loc-Line
Insulated thermal mugs with open bottom handle or open hand slot integrated into design
Grooming

Handle options for making holding and using toothbrush easier
Custom made orthoplast floss holder inserted into u-cuff

Automatic toothpaste dispenser ranges from $5-$40
Easy Access sink and stable pump style soap dispensers. Motion-activated also available. Battery-run adapters for sinks at $50

Countertop motion activated soap dispenser
SimpleHuman $45
Long-handled loofah with handle and slip-on wash mitt
Slip-on hair and body brushes
Scrubber with loop and slip-on style shower head. Made by Delta-available at Home Depot

Selecta – Band attached to shower head
Universal cuff with dycem/non skid strap to hold grooming items stable – brush, razor, electric toothbrush
Comb woven through hair band on other hand.
Meg’s Movie Minute videos on YouTube

Hair dryer stand
Available at Target and Amazon
Cabinet bumper and splinting material for easier on/off button.

Switch is “punched” in to aid in turning shaver on.
Clear drinking straw stuck in foam ball stabilizes a Q-tip for easier use

Razor with custom u-cuff/handle
Make-up station

Slant board - items attached with velcro, built in mascara holder and mounted mirror. Custom U-cuff for mascara wand
Eyeliner inserted into Wanchik Writer
Tommy tape or Coban can be used to attach make-up brushes to clear tubes to extend reach.

Also makes holding and manipulating brushes easier.
Coban wrap, built up foam and teeth work for opening and applying mascara
Both hands used for stabilizing and applying lipstick and blush
Adaptive Clothing Websites

- www.endlessability.com/media.php
- www.legawear.com
- www.heelswithwheels.com
- www.wheeliechix-chic.com/
- www.izadaptive.com/
Dressing

Dressing hook/splint fabricated from orthoplast used for pulling up pants. Rubber insert on inside of Gloves for Life can be tacky enough to help with pulling pants up.
Pocket dresser – more heavy duty and versatile than traditional zipper pull and button hook. Universal-cuff attached.

Zipper pull – commercially available but easily made with key ring, cord, or zip ties.
MagnaReady shirts - magnetically infused buttons

Magnetic jewelry clasps – bracelets and necklaces
Endless Ability jeans— made specifically for wheelchair users

- Lower Front
- Higher Back
- No seams or pockets in back
- Reinforced belt loops
- Lower front pockets for easier access
- Hidden catheter zipper on inseam
Cut for a seated position with increased length in back

Cape allows for increased independence with putting on coat
Dressing loops attach and detach easily. Slip hand inside large loop and use wrist extension and elbow flexion to pull up.
Backs of shoes cut off and replaced with elastic or neoprene loop. Can be done by a cobbler. Attaches with extra durable Velcro along the side of the shoe.

Webbing loop riveted to heel
Bowel and Bladder
Cathing

Supports penis to stabilize for ICP. Available through www.icancath.com

Catheter tube holder made with barrette and orthoplast. Can be made with various sized grip or can be made to insert into a rigid u-cuff.
Hook and strap system for getting pants out of the way while doing intermittent catheterization. Attaches under wheelchair seat and secures onto brake.

Betty Hook and Bungee Cords
Good solution for urinating quickly. Regular urinal was large and cumbersome. Used Gatorade bottle. Could hook on his chair.

Pull tab loop for pulling on external catheter
Female urinal user has adapted with a cuff and stores in an ice climbers bag.
Leg Bag Emptying

Velcro attachment with loops on end allow for removal of leg bag for emptying without having to remove entire leg strap.
Pants ring to allow for pant leg to be pulled up for emptying catheter

Custom catheter bag opener made from orthoplast “ring” and metal shaft
JB3 Leg Bag Valve System

Mechanical leg bag emptying system that requires less than 3 # of pull/force to operate. Multiple modification options to allow for access. $250
RD Electric Bag Leg Opener

Enables the user to empty the leg bag with a switch.

Powered by the power wheelchair battery (24 volts) or battery-powered for manual wheelchair users.

$300–$600
Self Catheterization

Key features of many catheters for those with limited hand function:

• Easy to open packaging
• Thumb holes for easing draining
• Advancer function to prevent tubing from retracting back into bag
• Introducer tip to reduce risk of infection
• Self contained lubricant chamber
Speedi-Cath

Advance Plus Catheter

MTG EZ-Gripper
Knot the cath to create a loop for thumb or finger to help with intermittent catheterization.

Cath Hand – slip on style splint which holds the catheter. Held in place with wrist extension, release and advance the catheter by relaxing hand.
Asta Cath for women has three guide holes that align with the urethra to help with passing/guiding the catheter.

Leg Spreader with mirror enables both hands to be used and allows for visualization
Bowel

• Ensure good education regarding use of digital stimulator – small movements, good lubrication, proper amount of pressure.

• Consider having suppositories pre-opened by someone and stored in a zipper style zip-loc bag in the freezer.

• Flip top lubricant containers or place/purchase lubricant into pump style container and stabilize it.

• Use mirrors to help with visualization of rectum and to monitor stool consistency – may be mounted on commode chair or on floor.
Suppository inserter and digital stimulator mounted onto universal cuff
Custom made palm-based suppository inserter and digital stimulator made from splinting material.
Beyond the Basics

- Writing
- Phone and Computer Access
- Cooking
- Laundry/Cleaning
- Home Access
- Recreation
Writing Options

Figure 8 style splint

Custom-made writing splints
Built up foam and tenodesis grasp. Roller ball pens seem to work well in reducing amount of force needed.
Cooking/Kitchen

Quad Knife – useful for opening packages and cutting. Available through www.QuadTools.com
Ergonomic handled knife works well for some people.

Upright handle knife with overhang or strap attached.
Vidalia Chop Wizard- insert with large holes

Food chopper- spring loaded plunger; works best for herbs and garlic.

Mini Food Processor with easy to operate raised button
Slip on tools for cleaning and peeling vegetables. Available at Walmart
Tray with bean bag on bottom molds to user’s lap and stays stable.

Insulated tray used as work surface.
Spatula with handle made from splinting material riveted onto it. Could also insert any utensil into universal cuff.
Upright handle spatula
Cutting board with hole makes it easier to pick up.

Flexible Cutting board makes it easier to move and pour ingredients. Available at IKEA.
Cord attached to bowl acts as a handle allowing it to be moved more easily.

Store food items in grocery bags for easier retrieval.
Dycem can be used to operate a pepper mill. Battery-operated or ‘rabbit ear’ salt and pepper grinders also available.
Plastic devices useful for more easily closing and accessing bags

Available at IKEA

www.closeman.com
Slide-out cutting board makes transferring items from microwave to tray on lap easier.

Side-opening counter top oven with large handle and transition board.
A key ring is attached with a cable tie to the oven door handle.

Built-in wall oven with pull out rack.
Retrieving Hot Items

Oven rack pull

Neoprene oven mitt
Handle for holding and pouring liquids

www.varsam.com

Plastic liquid measuring cup with open bottom handle for pouring things like eggs or batter
OXO brand rubber bottomed bowls are stable for mixing and light enough for pouring.
Other Helpful Cooking Tools/Tricks

- Salad spinner for washing vegetable
- Electric fry pan or cast iron pan for stability while cooking
- Custom u-cuffs with kitchen utensils inserted or attached
- Zip ties around containers in cupboards for easy retrieval
- Flip top spice containers
- Travel squeeze bottles or flip top plastic bottles for oil and condiments
- Store food items in plastic bags in refrigerator to grab them easily
- Flexible Spatula for spreading
- Over the sink cutting board
- Motion sensor garbage can
- Ove Glove silicone oven mitt
- George Foreman Grill
- Crockpot
Laundry

Washer and dryer are raised on pedestals with pull-out storage basket and hinged on opposite sides. Countertop has knee space.

Single use laundry detergent capsules
Options for turning on washer and dryer or stove: end of dressing stick or knob turner
Basket for transporting laundry

Leather or webbing loop attached to dryer handle for opening
Cleaning

Broom with ‘stop’ made from friction tape and a ring of tape to help keep hand from slipping.

Easy rolling vacuum cleaner with telescoping tube for extended reach.
Home Access

Kwikset Kevo Bluetooth-Enabled Deadbolt—your smartphone is your key. Touch the lock to open or use the key fob. Can also send e-keys to caregivers or family members.

SimpliciKey remote control electronic door opener.
Available at COSTCO and amazon.com
Metal plate screwed onto key to provide larger surface for increased grip.
Old credit card used in photo on right
Door Finger – tool for closing doors

www.doorfinger.com

Handle allows user to close door after entering or exiting a room.
Low cost hook for holding grocery bags stable.

Webbing strap loop attached to side guard to make removal easier.
Keys placed on wrist band and kept on armrest

Loop on wallet with zip ties or key rings. Open style wallet makes getting cards, money easier.
Bus pass attached on retractable key ring

Self-opening scissors

Electric letter opener and stapler
Phone Holders

Wire loop taped onto back of phone or camera strap attached to phone allow easier retrieval and use of phone.
www.rammount.com

RAM x-grip adhesive phone holder

RAM tubular style mounting option
iOttie suction cup cell phone holder

Separate case and attachment, locking or magnetic. Shown on bike mount. www.rokform.com
Options for mounting phone on table or laptray

iPhone Naja Coil Holder
$34.99
Can mount on bedrails

iPhone Holder
$24.99
Flatpad armrests

www.thoughtoutbiz.com
Splinting material used to make platform for phone—rivet another piece of material so you can rotate the phone.

Rivet between layers so you can rotate phone. Velcro to platform.

Drinking straw or pencil rivet stuck in end to “catch” and open phone.
Touch Screens

- Capacitive—requires conduction
- Resistive—requires force
Stylus Options for Phone and Computer

Stylus mounted in universal cuff used here for phone and tablet.

Serpentine stylus that can be molded for a custom fit/position.

www.faraday.com
Low tech styluses

Typing Aid with adhesive foil attached

Metal tubing with tip made from kitchen sponge—inserted into universal cuff
Commercially available typing aids for resistive keyboards

www.choicemobility.com

www.patterson.medical.com
Finger “splint” with tip for accessing buttons

Universal cuff with short pencil or rod made from splinting material
Finger Splints—Touch Screen Access

Splinting options for stabilizing finger while leaving tip free for touch screen devices. Can also use handle bar grip with end cut off, piece of narrow diameter PVC piping or sock over hand with hole cut out for finger.
Computer and Tablet Mounts and Holders

Walle straps and accessories for iPads
Lap trays and Tables

Scotty lap tray – Kristen Model

Drive Medical Pivot and Tilt Adjustable Overbed Table Tray
Recreation

Active Hands Gloves
Long handled garden tools with active hands gripping gloves
Ergonomic style slip-on gardening tools

Raised garden bed with space for knees
Aquatic Hand Paddle
Custom and commercially available fishing pole holders

www.receive-all.com
Low tech card holder made from an old phone book and duct tape. Upside-down egg carton also works.

A key ring and anti-slip material allows for easier use of a remote control.
Custom hand tool made from splinting material for pressing autoharp buttons and picking strings.
Orthoses & Splints for Upper Cervical SCI
Resting Hand Orthoses
C7 and above
Resting Hand Orthoses
Goals:

• Protect the wrist and finger joints

• Prevent losing range of motion

• Maintain the natural arches of the hand
  – (Preserves the appearance of the hand)

• Prevent skin breakdown
“Functional” Hand Position

- Wrist in neutral – 30 degrees of extension
- Fingers are mostly straight
- Adequate thumb opposition
Wear Schedule

• 6-8 hrs per night
• Check skin daily
• May eventually discontinue if the wrist and fingers do not develop stiffness
Custom Fabricated Thermoplastic
Pre-Fabricated Examples

Air Soft™ Resting Hand Splint $80 - $135
www.amazon.com
www.pattersonmedical.com

Rolyan® Intrinsic Plus Hand Orthosis
$80 - $120
www.pattersonmedical.com
Wrist Extension Splint
C5, C6
Wrist Extension Splint
C5 and above

• Compensate for diminished or absent wrist strength

• Provides stability to the wrist joint

• Universal cuffs are often used with this type of splint to improve function
Wrist Extension Splint with universal cuff

Stylus with iPad

Toothbrush
Thumb Opponens
C6, C7
Tenodesis

Wrist Down

Wrist Up
Thumb Opponens
Thumb Opponens
Thumb Opponens
WDWHO
Wrist Driven Wrist Hand Orthotic
C6, C7

Assists with a stronger tenodesis function by mechanically forcing the fingers and thumb to flex when the wrist is extended

– Costly
– Challenging to get on/off

$600 - $700
Tenodesis Splinting
C6, C7

• Intentional tightening of soft tissues
• Only with complete injuries (ASI A)
• 2 different splints, alternating nightly
• Wear until desired “grip” is obtained
Tenodesis Splinting Flexion Wrap

- Fingers flexed into “fist” position
- Thumb held straight and close against the fingers
- Wrist positioned in ~45 degrees of extension
Tenodesis Splinting
Finger Extension with Wrist Flexion

- Lengthen fingers into extension
- Thumb held straight and close against the fingers
- Wrist positioned in ~30 degrees of flexion
Wear Schedule

• 4-8 hours nightly

• Alternate splints every other night

• Assess range of motion and grip quality daily
Before and After
2 weeks of tenodesis splinting
Exercise

—What the research says

• Exercise = increased strength and decreased pain

• People in an exercise group reported less stress, depression and increased quality of life

• Benefits for people with acute and chronic injuries
Exercise resources

Forum Videos
http://sci.washington.edu/videos

• Get Moving! Exercise after Spinal Cord Injury
  —Kristin Kaupang
• Protecting Your Shoulders and Staying Active after Spinal Cord Injury
  —Kristin Kaupang
• Universal Fitness: Fitness after SCI
  —Cathy Warms
Community options

- HMC and UWMC Wellness Program
  - http://sci.washington.edu/transitions
  - Exercise groups
  - Yoga
- YMCA
- Exercise VHS/DVD & Quick Series Booklet
  - http://ncpad.org/369/2068/Exercise~Program~for~Individuals~with~Spinal~Cord~Injuries~~Tetraplegia~VHS~DVD~~~~~Quick~Series~Booklet
Neuromuscular electrical stimulation (NMES)

• Enhance recovery in early rehab
  – Supplement to exercise
  – Use with activity to enhance movement

• Use as an Assistive device in later rehab
  – Wear the device to do an activity
Neuromuscular Electrical Stimulation: Assistive Devices

NESS handmaster
• Bioness, Valencia, CA
• Available but expensive
• Typically not covered by insurance
• Large and cumbersome
Bionic Glove

• Neurokinetics, Edmonton, AB

• Used with people with active wrist extension

• Not commercially available

Photo from http://www.ualberta.ca/~aprochaz/bgtemp.html
Freehand system

- Neuro Control, Cleveland, OH
- Surgically implanted
- Stimulates muscles of the forearm to enhance grasp
- Not commercially available but... they are working on a second generation implantable device

Photo from: http://uthscsa.edu/opa/issues/new34-9/paralyzed.html
Surgical Interventions

• Tendon transfers

• Nerve transfers
Tendon transfer surgery

• Tendon from an active muscle is transferred to the insertion of an inactive muscle

• Goals
  – reproduce lost movement at a specific joint to improve independence

• Procedures focus on restoring
  – Elbow extension
  – Wrist movement
  – Hand opening and closing
For example

Biceps to triceps transfers

- Ability to raise arm against gravity
  - Increase reach
  - Increase independence with transfers
  - Enhance w/c propulsion
Candidates (typically)

- C5 or greater (C5-C8)
- Neurologically stable
- Motivated
- Good general health
- No contractures in UE joints
- Well-controlled spasticity
- Good seating/trunk stability
- Have realistic expectations
Tendon transfer research

• Studies have shown patients experience functional gains long term
• More research is warranted
  – No one approach for surgery has become standard
  – Risks of surgery, lack of access to health care providers
Nerve transfers

• Not as common as tendon transfers, newer technique
• Less time immobilized after surgery
• One nerve transfer can result in multiple functions gained
• Longer time for signs of success
  – Nerves heal at approx 1mm per day which could result in 9-12 months before effects are noted
Barriers

• Lack of access in the NW
  – Unable to identify a surgeon that consistently works with rehab physicians and performs this surgery with people with tetraplegia
Useful “DIY” Materials

• Velcro One Wrap
• Instamorph—moldable plastic
• Sugru—moldable self setting rubber
• Plastidip— rubberized coating
• Coban or friction tape—antislip/friction products
• Dycem—antislip material
• Built up foam—used to enlarge grip/hand holds
• Loc-Line—modular hose for mounting things at any angle
• Industrial twist ties
Forum resources for other self care topics not covered today

Sexuality
• http://sci.washington.edu/sex

Driving
• http://sci.washington.edu/info/forums/reports/driving.asp

Parenting
• Upcoming SCI Forum on April 8th 2014
Eating and Drinking YouTube Videos

http://www.youtube.com/watch?v=D_m3pCYWaTg
Make Up YouTube Videos

www.youtube.com/watch?v=2XCYuxBmYKc

www.youtube.com/watch?v=JSvwjdhQ6Do&list=PLZVItOlkBzBifKQevo8FNcaiSre7eS_-_y

www.youtube.com/watch?v=D-w1MOM2e4M&list=PLTUNYNKnKovlGMlOrjEaGxm4VAJY0wMlsc

www.youtube.com/watch?v=0XwRUVt8uO0
Dressing YouTube Videos

www.youtube.com/watch?v=5cz9sLzMpiE

www.youtube.com/watch?v=9ulZEBxePDc

www.youtube.com/watch?v=qzrwnr3Twpo

www.youtube.com/watch?v=6HT-yjaeCJU&list=PL_vA5Qr8-k2McXxQsfkIbrdK0u1_-cqLJ
Cathing and Bowel Care YouTube Videos

www.youtube.com/watch?v=G4-LwfehDZw

www.youtube.com/watch?v=2CN6p3nTvaw

www.youtube.com/watch?v=Uq120f5Qkm4
Cooking YouTube Videos

• http://www.youtube.com/watch?v=P5DEyYQ5Wtg
• http://www.youtube.com/watch?v=eoOhozZ5u-o
• http://www.youtube.com/watch?v=0QdQO9Au2wU
• http://www.youtube.com/watch?v=bARVSkgd8YM
• http://www.youtube.com/watch?v=BG31m31ElUc
• http://www.youtube.com/watch?v=GWYPSw_L3gY
Cleaning Laundry YouTube Videos

• http://www.youtube.com/watch?v=lzvV3aQyy4Q

• http://www.youtube.com/watch?v=N8gHSjgo4Q

• http://www.youtube.com/watch?v=3fCj1-CS6n0
Useful Websites

• www.spinalstips.se
• www.handihelp.net
• www.adaptiveoutdoorsman.com
• www.facingdisability.com/
• www.mobilewomen.org/
• www.accessanything.net/
• www.wrightstuffbiz.com
• www.abledata.org
• www.gimpgear.com
• www.sci-info-pages.com/adaptive.html
In summary. . .

- Be creative and keep an open mind
- Share your resources/good ideas because people are looking for them!
- Check out “Tips from the Wheel World” at: http://sci.washington.edu/tips/
References


Sukhvinder, K, Verrier, M. A Synthesis of Best Evidence for the Restoration of Upper-Extremity Function in People with Tetraplegia. Physiotherapy Canada 2011; 63(4);474-489