

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**
 - *<http://sci.washington.edu/summit2013/>*
- Hiring caregivers presentation
 - **Personal Caregivers: Tips, Tricks and Tales from Individuals with Spinal Cord Injury**
 - *<http://sci.washington.edu/info/forums/reports/caregivers.asp>*

Options for UE rehabilitation

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

Eating and Drinking



Fork inserted into a universal cuff

Dining with dignity utensils-
worn on thumb and
forefingers

www.diningwithdignity.com





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



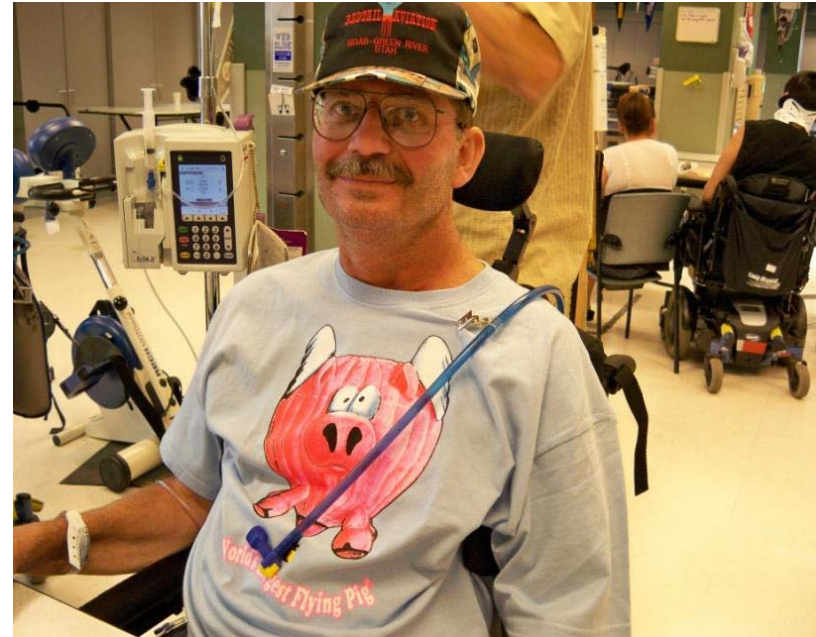
Rocker knife for cutting food. Use with two hands and tenodesis or adapted with a custom cuff for one-handed use



Drinking



Camelbak tubing
mounted on Loc-Line



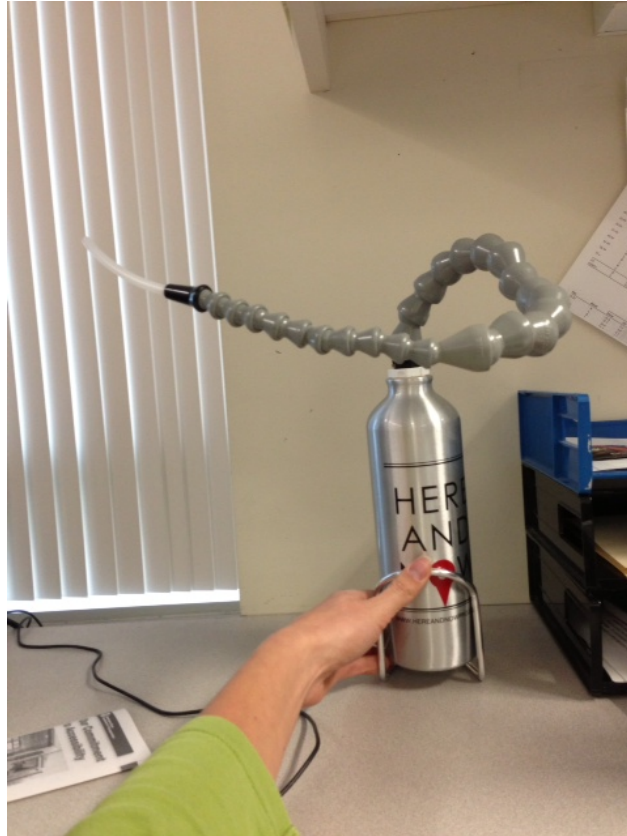
Tubing clipped to
shirt with badge clip
for easy access

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



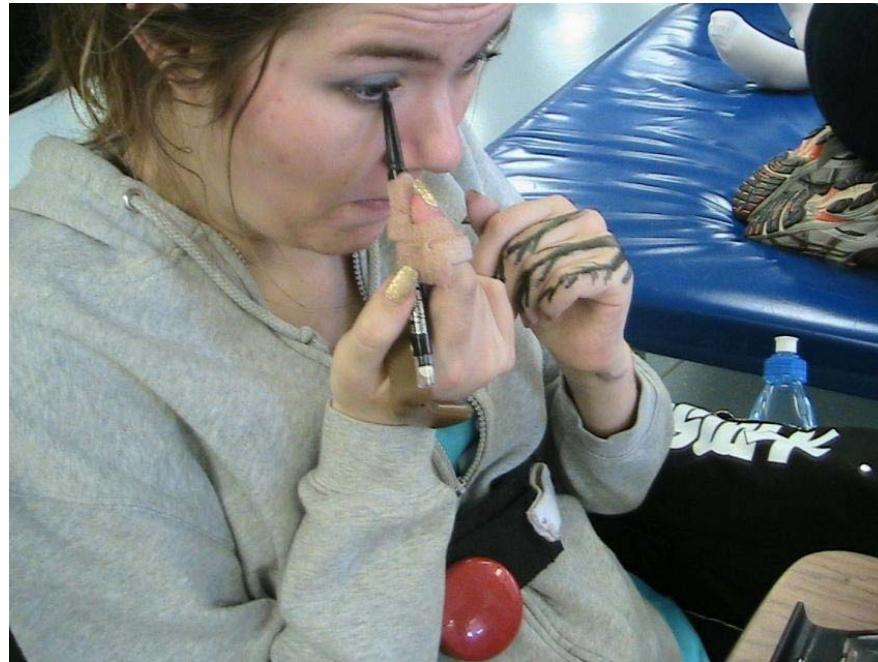
Razor with custom
u-cuff/handle

Make-up station



Slant board - items attached with velcro,
built in mascara holder and mounted mirror.
Custom U-cuff for mascara wand

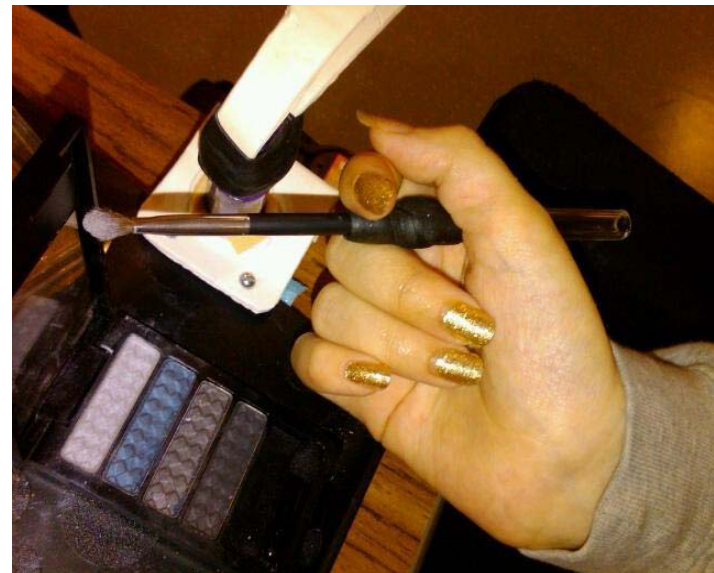
Eyeliner inserted into Wanchik Writer





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/
- www.rollimoden.de/epages/RolliModen.sf/en_GB/?Locale=en_GB

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.





Zipper pull –
commercially available
but easily made with key
ring, cord, or zip ties



Pocket dresser – more heavy duty and
versatile than traditional zipper pull and
button hook. Universal-cuff attached.



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.

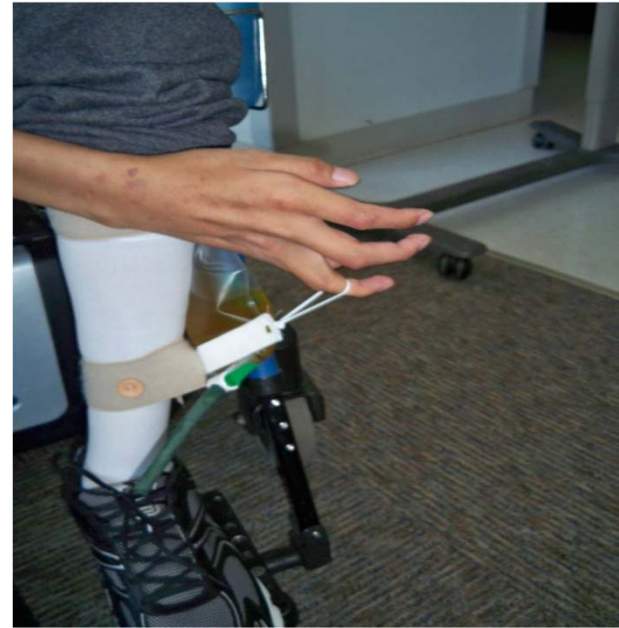
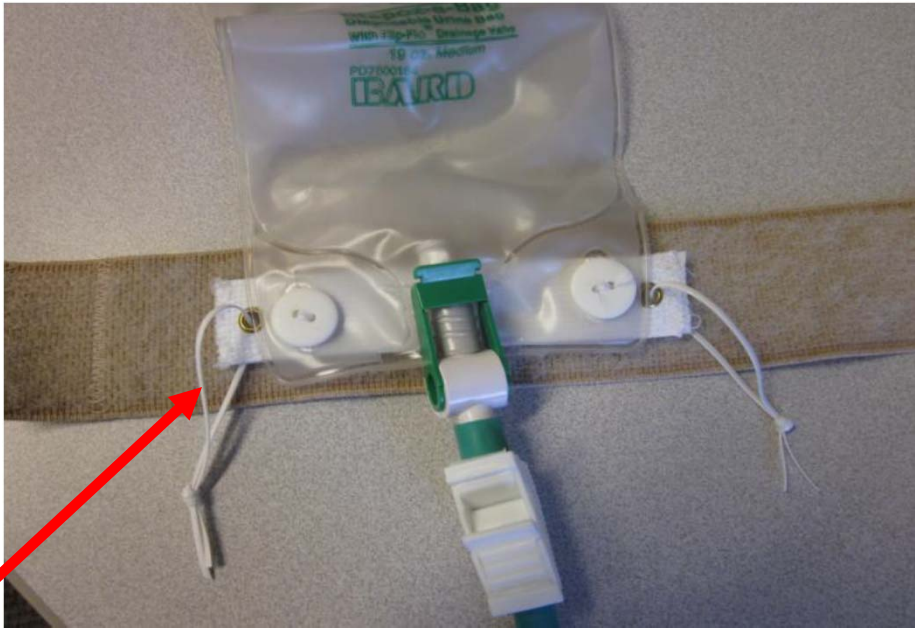
Pull tab loop for pulling on external catheter





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



PerfIC Cath

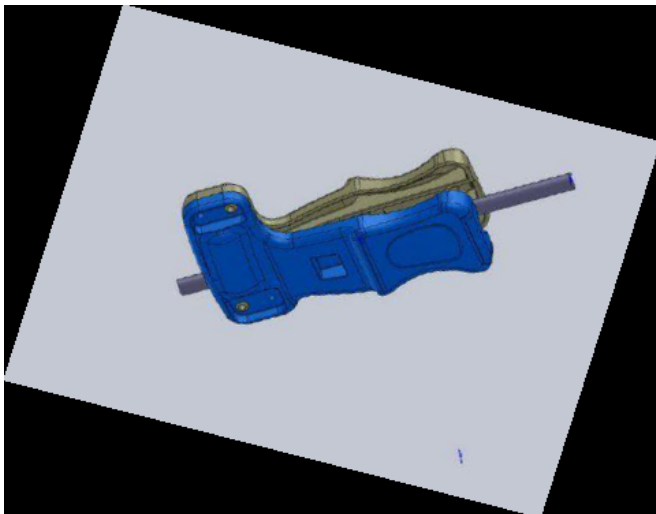
www.adaptamedical.com



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



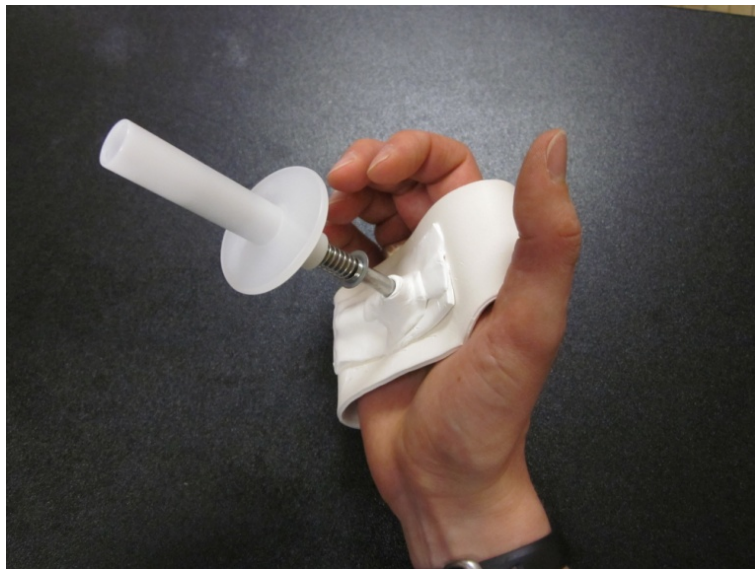
Bowel

- 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

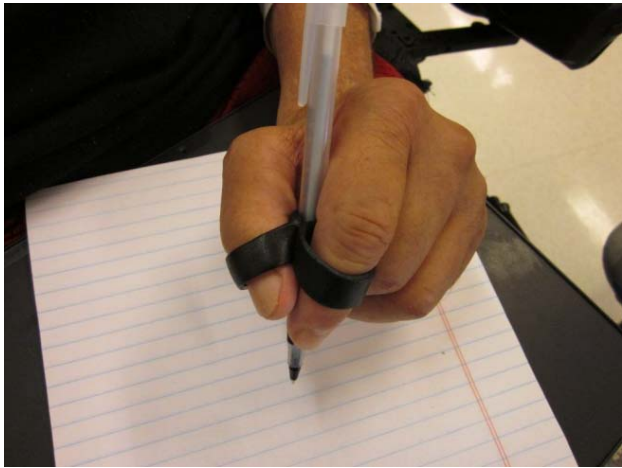


Figure 8 style splint



Custom-made writing splints





Wanchik Writer



Click in Pen Holder
inserted into plastic u-cuff



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



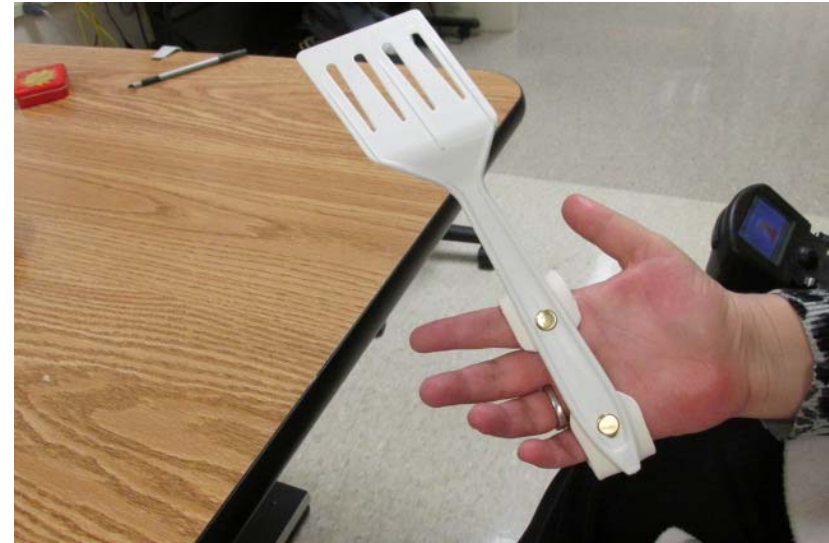
Slip on tools for cleaning and peeling vegetables. Available at Walmart



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



© 2008 spinalistips.se

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
- Oven 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



Leather or webbing
loop attached to dryer
handle for opening



Basket for
transporting laundry

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

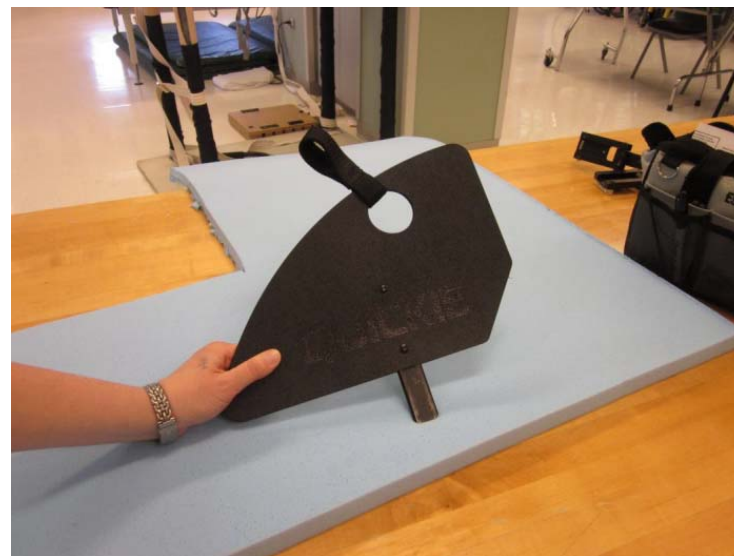


Handle allows user to close
door after entering or
exiting a room.

Miscellaneous Ideas



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

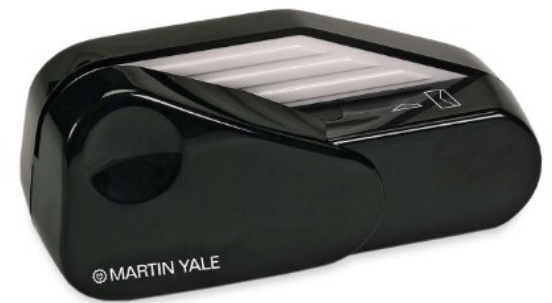


Bus pass attached on retractable key ring



Electric letter opener and stapler

Self-opening scissors



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



Custom cell phone holder using Loc-Line.
Available from www.modularhose.com.
Splinting material and cabinet bumper
added for lever arm to access the
on/off button.

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



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

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



Touch Screens

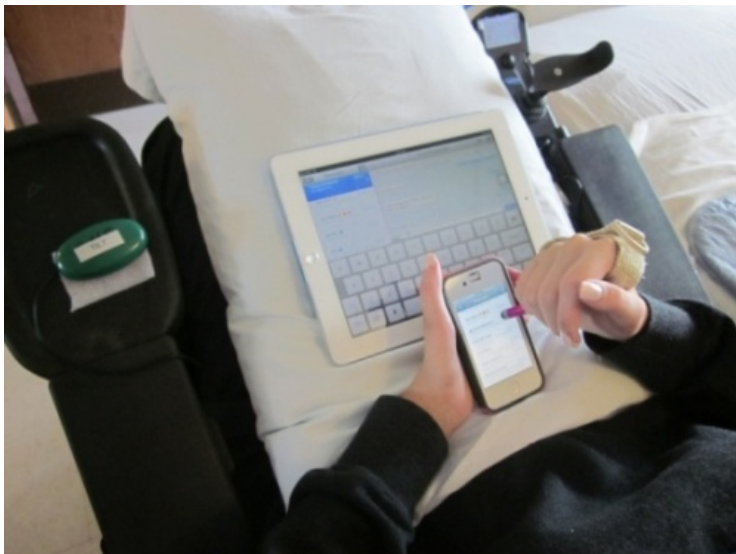
- Capacitive—
requires conduction



- 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



Metal tubing with tip made from kitchen sponge—
inserted into universal cuff

Typing Aid with
adhesive foil attached



Commercially available typing aids for resistive keyboards

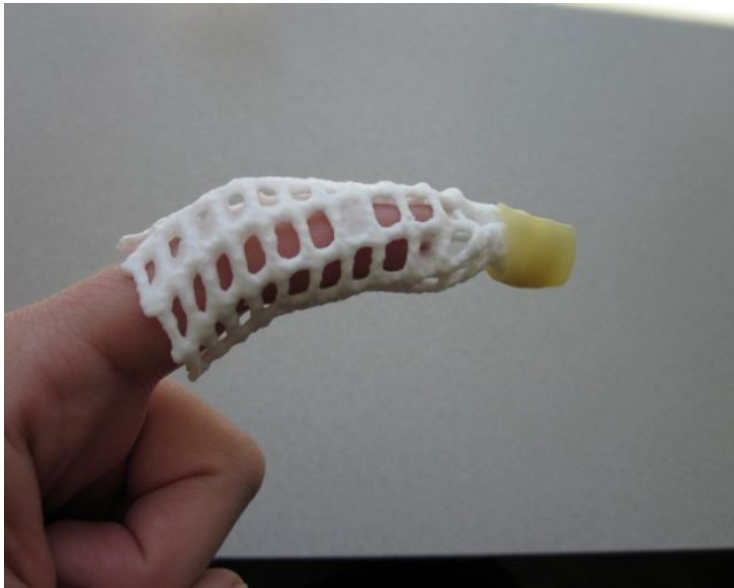


www.choicemobility.com



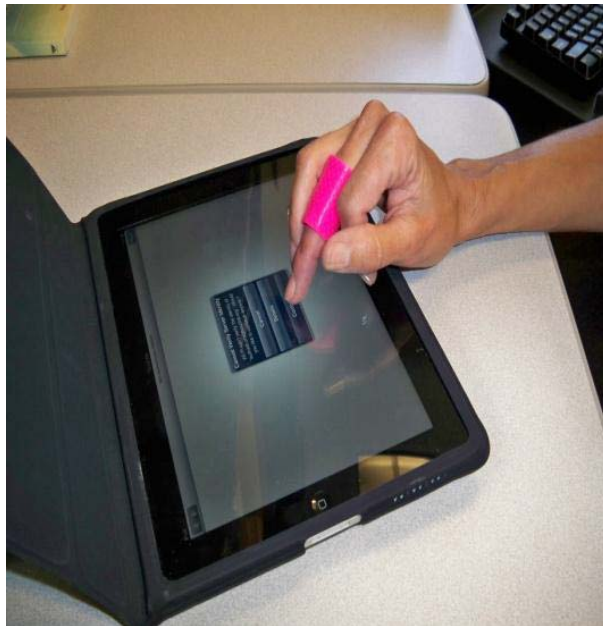
www.patterson.medical.com

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



Garden Shears

www.quadtools.com



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

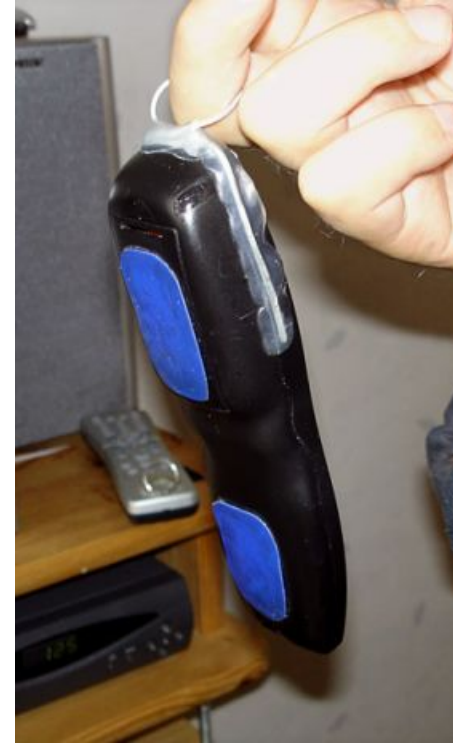


Custom and
commercially available
fishing pole holders
www.receive-all.com





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



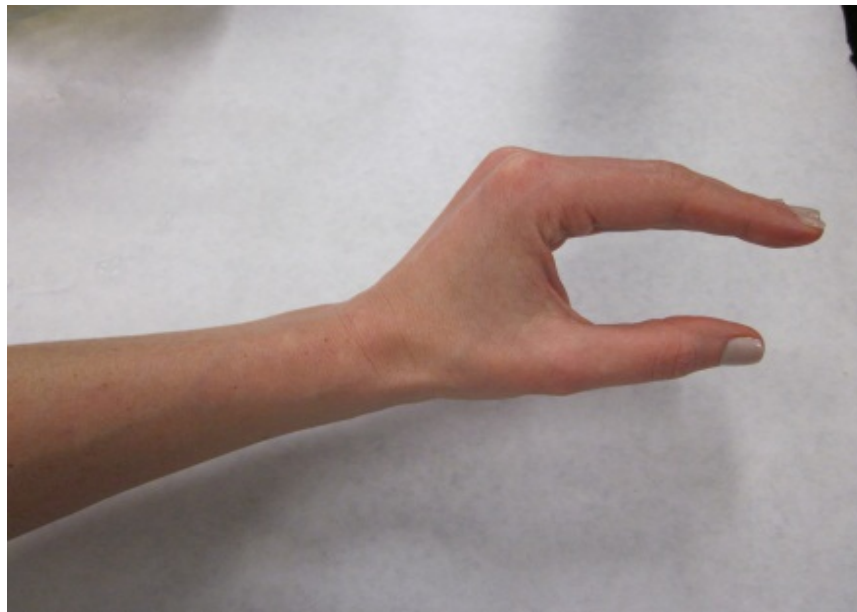
Resting Hand Orthoses

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

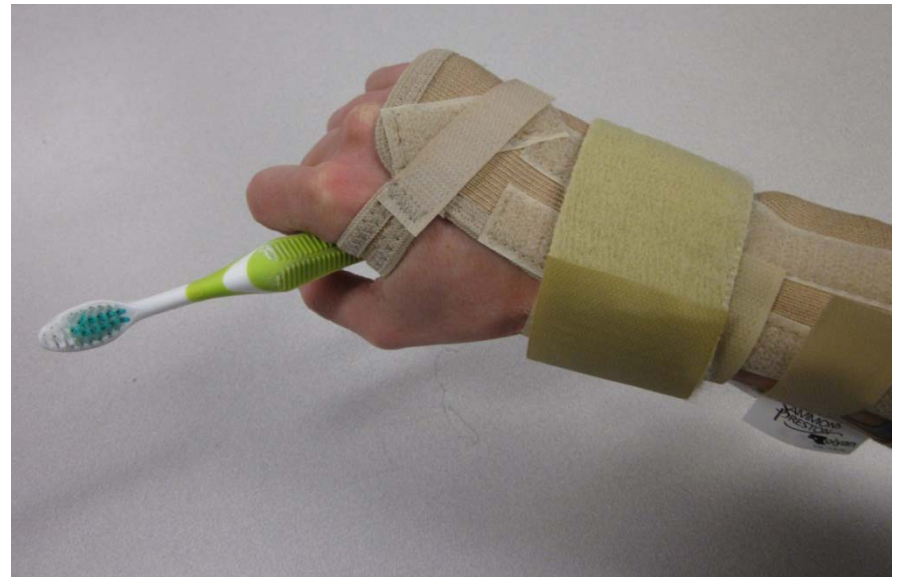
- Compensate for diminished or absent wrist strength
- Provides stability to the wrist joint
- Universal cuffs are often used with this type of splint to improve function

Wrist Extension Splint with universal cuff

Stylus with iPad



Toothbrush



Thumb Opponens

C6, C7



Tenodesis

Wrist Down



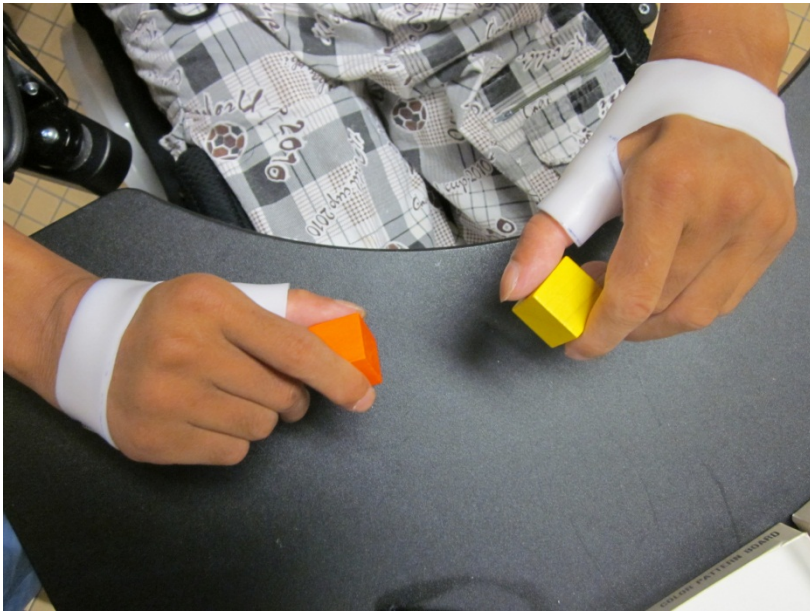
Wrist Up



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 (ASIA 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

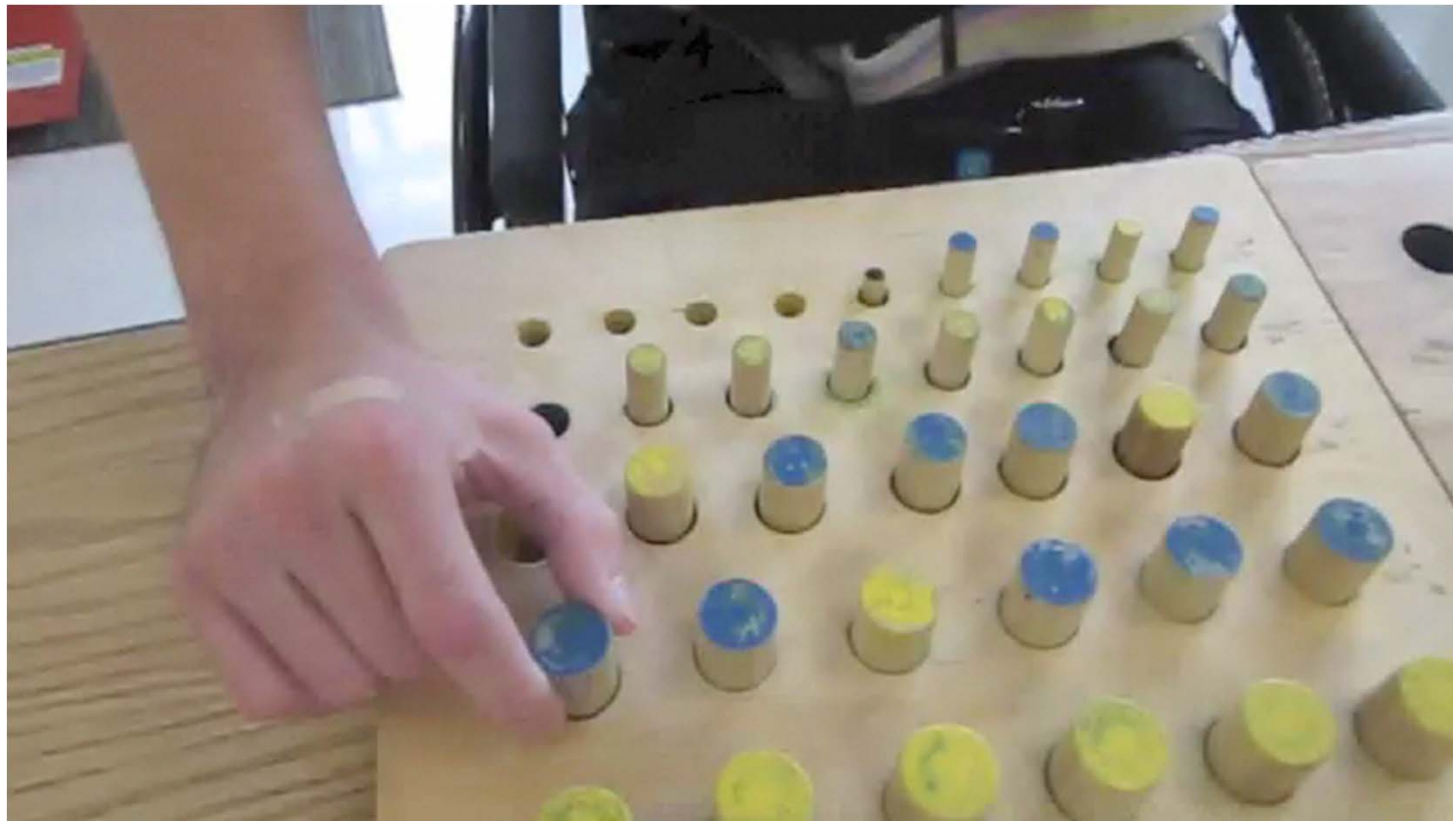


- Lengthen fingers into extension
- Thumb held straight and close against the fingers
- Wrist positioned in ~30 degrees of flexion

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

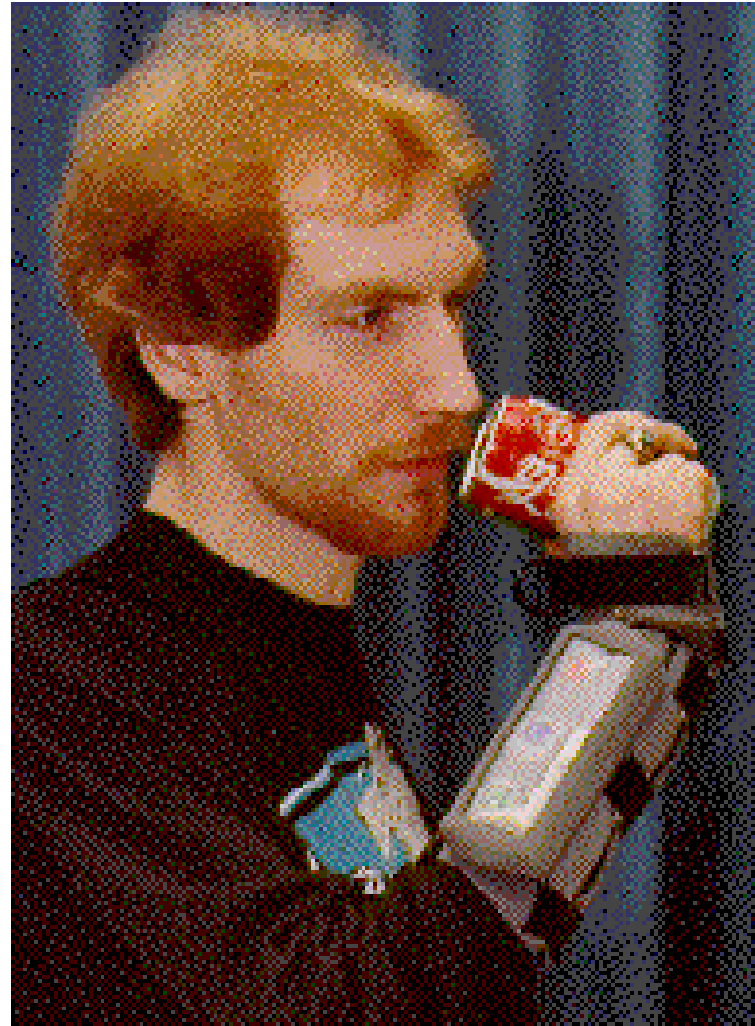


Photo from
<http://www.ualberta.ca/~aprochaz/bgtemp.html>

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**

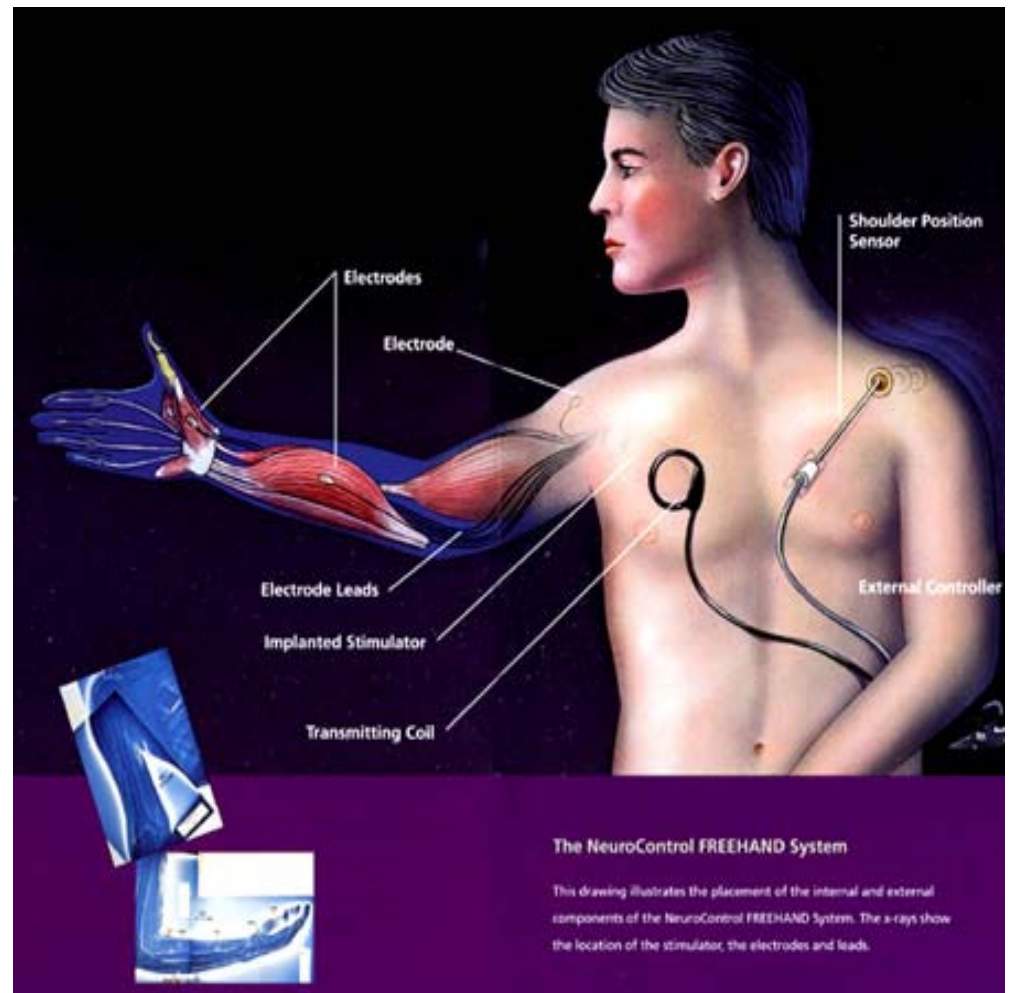


Photo from: <http://uthscsa.edu/opa/issues/new34-9/paralyzed.html>

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=PLTUNYnKovIGMIOrjEaGxm4VAJY0wMls_c

www.youtube.com/watch?v=0XwRUVt8u00

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-k2McXxQsfklbrdK0u1_-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=0QdQ09Au2wU>
- <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=N8gHSjgog04>
- <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/>

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