

ARC^{EX} Therapy: Exercise Examples

In this resource, you will find a selection of the exercises that were used in conjunction with ARC^{EX} Therapy during the Up-LIFT trial¹. These can be used as starter ideas for ARC^{EX} Therapy sessions. The choice of an exercise should always be tailored to the user's needs and personal goals.

Principles to uphold during ARC^{EX} Therapy

- Tailor the activities to align with the user's functional goals
- Select meaningful tasks to maintain motivation and engagement
- Remind users to actively engage in the exercises with intent and focus
- As in all motor learning, ARC^{EX} Therapy is most effective when:
 - A high number of repetitions are practiced
 - Tasks have real-life relevance for the user
 - Complex tasks are broken down into smaller parts if the full task cannot yet be performed
 - Manual, hand-over-hand assistance is limited to providing a reference for correct movement, then maximizing voluntary engagement thereafter
 - Proprioceptive feedback is emphasized, such as through closed-chain positions
 - The instructions encourage biomechanically correct movement patterns

Tips

- The height of the table in front of the user should be adjusted individually to perform the activities comfortably
- It may be beneficial to work sequentially from proximal to distal exercises to assess voluntary capability
- Consider a general warm-up before engaging into focused goal-oriented exercises

¹Moritz, Chet, et al. "Non-invasive spinal cord stimulation for arm and hand function in chronic tetraplegia: a safety and efficacy trial." *Nature Medicine*, 2024.

ARC^{EX} Indication for Use (US): The ARC^{EX} System is intended to deliver programmed, transcutaneous electrical spinal cord stimulation in conjunction with functional task practice in the clinic to improve hand sensation and strength in individuals between 18 and 75 years old that present with a chronic, non-progressive neurological deficit resulting from an incomplete spinal cord injury (C2-C8 inclusive).

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Bilateral grasp

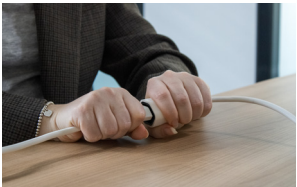


Containers

Opening and tightening container lids

Challenge

Stronger vs. pre-opened lids
Use lids with multiple seals
Fill container, open without spills

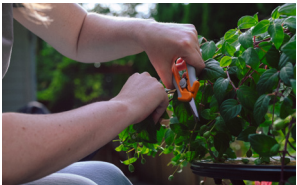


Extension cords

Plugging extension cords together and separating them using both hands

Challenge

Cords with stronger attachments vs. pre-loosen plugs
Perform for speed
Vary arm position



Scissors

Cutting out shapes from paper (exercise caution when handling sharp objects)

Challenge

Thickness of paper
Complexity of shapes
Change hands



Nesting boxes

Separating and placing inside each other

Challenge

Perform for speed
Hold only with fingertips



Rubik's cube

Twisting while stabilizing with one hand

Challenge

Perform for speed
Vary directions of twist
Partial turns



Cups

Flipping cups simultaneously

Challenge

Adapt weight
Size of cups
Vary movement pattern



Can opener

Squeezing the handle with one hand while rotating the lever with the other hand

Challenge

Size of cans
Change hands



Slinky

Supinating and passing slinky from one hand to the other

Challenge

Vary arm position
Fully expand slinky
Full vs. partial supination to pronation



Flexbar

Opposing twists, vertical or horizontal bar

Challenge

Vary resistance of bar
Vary trunk support
Vary arm position

Unilateral grasp



Cans / bottles

Bringing a bottle/can to mouth

Challenge

Adapt weight
Change hands
Vary shape of cup



TheraPutty

Cutting putty with cutlery; gripping putty in fist (exercise caution when handling sharp objects)

Challenge

Thickness of putty
Length of cuts
Vary angle of cuts
Cutlery handle



Grasp development

Grasp and release

Challenge

Hold and grasp in air
Thickness of material
(towel vs. napkin)

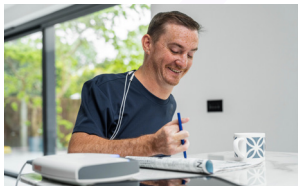


Baskets

Picking up and carrying a grocery bag or basket using a hook grasp

Challenge

Adapt weight
Vary types of handles
Change hands



Handwriting

Writing name or writing a letter to someone

Challenge

Use adaptive equipment
Vary length of sentences
Vary size of letters

Bilateral pinch



Buttons

Buttoning and unbuttoning buttons in shirts/coats/pants

Challenge

Size of buttons
Thickness of buttons
Eyes opened vs. closed



Shoes

Lacing and unlacing shoe

Challenge

Thickness of laces
Size of eyelets
Vary over/under pattern
Vary length of plastic tip on laces



Ziplocs

Opening Ziploc bags using one hand to stabilize and one hand to open

Challenge

Hold bag suspended in air vs. supported
Single vs. double zipper bags
Full vs. empty bags



Zippers

Zippering and unzipping zippers on clothes or gear

Challenge

Resistance of zippers
Zippers with curved path
Size of zipper hold
Vary the angle of pull/push



Knots

Tying variable knots, difficulty based on ability

Challenge

Vary string thickness
Vary knot complexity
Use both hands equally

Unilateral pinch / complex pinch



Stacking

Building using pinch
(wooden stackers)



Cards

Holding cards, playing cards



Coins

Flipping and holding coins or
poker chips, putting coins into
box slots, removing coins from
purse or wallet



Clothespins

Pinching clothespins to paper,
clothes, or other objects



Stickers

Peeling stickers and placing
them on surfaces (e.g., water
bottles, journals)

Challenge

Vary pinch (tip vs. lateral)
Pinch long side vs. short side
Vary angle of pinch and stack

Challenge

Hold more cards at once
Fan cards out
Pull multiple cards while holding
Vary card-flipping direction on table

Challenge

Thickness and size of coins
Place coin in slots of varying angles

Challenge

Strength of clothespins
Type of pinch
Perform for repetitions
Hang clothes from line

Challenge

Size of stickers
Place on surfaces in
certain orientation

Finger isolation



Keyboard

Tapping or typing on a
computer keyboard with
both hands, without pressing
multiple keys at once



Piano

Tapping on piano keys to play
music or follow a rhythm, without
pressing multiple keys at once



Active-assist finger isolation

Therapist assisting finger flexion
and extension while blocking
other fingers



TheraPutty

Poking holes using each finger
individually (can use both hands
simultaneously)

Challenge

Length of words/sentences
Keep hands floating on keyboard
Include numbers
Perform for speed

Challenge

Keep rhythm to play a song
Use all fingers vs. one at a time
Hold notes
Trunk unsupported

Challenge

Block proximal joints
Combined planar movements
(opposition) vs. uniplanar

Challenge

Thickness of putty
Depth of holes