

ARC^{EX} Therapy:¹ 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.

The ONWARD® Medical ARC^{EX} System is CE marked in accordance with EU MDR 2017/745.

CE Mark Indication: The ARC^{EX} System is intended to deliver programmed, transcutaneous electrical spinal cord stimulation in conjunction with functional task practice in the clinic and with take-home exercises in the home to improve hand sensation and strength in individuals between 18 and 75 years old that present with a chronic (>1 year post-injury), non-progressive neurological deficit resulting from an incomplete spinal cord injury (C2–C8 inclusive).

Bilateral Grasp

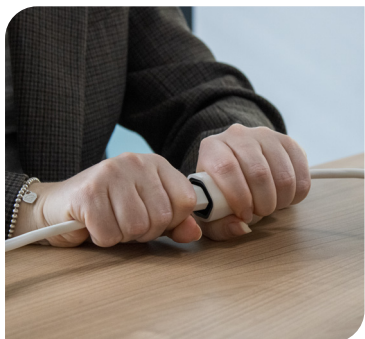


Containers

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

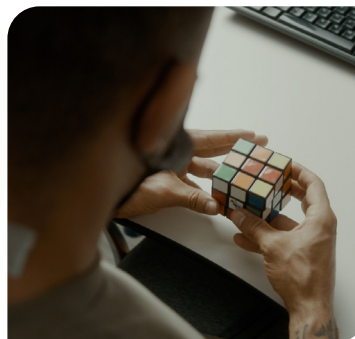


Nesting boxes

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

Bilateral Grasp



Can opener

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

Challenge

- Size of cans
- Change hands



Springy

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)

Unilateral Grasp



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

Bilateral Pinch



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)

Challenge

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



Cards

Holding cards, playing cards

Challenge

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



Coins

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

Challenge

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

Unilateral Pinch / Complex Pinch & Finger Isolation



Clothespins

Pinching clothespins to paper, clothes, or other objects

Challenge

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

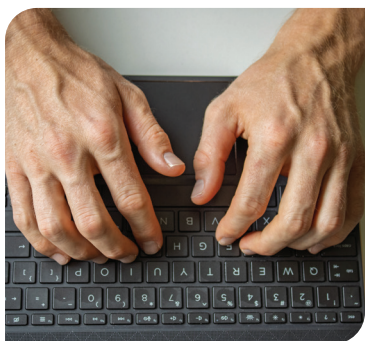


Stickers

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

Challenge

- Size of stickers
- Place on surfaces in certain orientation



Keyboard

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

Challenge

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



Piano

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

Challenge

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



Active-assist finger isolation

Therapist assisting finger flexion and extension while blocking other fingers

Challenge

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



TheraPutty

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

Challenge

- Thickness of putty
- Depth of holes