An Evidence Based Occupational Therapy Toolkit for Assessment and Treatment of the Upper Extremity Post Stroke

Brenda Semenko, Leyda Thalman,
Emily Ewert, Renee Delorme, Suzanne Hui, Heather Flett, Nicole Lavoie

(Winnipeg Health Region Occupational Therapy Upper Extremity Working Group)
(bsemenko@hsc.mb.ca)

April 2015
Updated February 2017

Table of Contents:

1.0 Acknowledgements:

The Winnipeg Health Region Occupational Therapy Upper Extremity Working Group would like to acknowledge and thank the following individuals for their contributions to this document:

Daniel Doerksen
Denali Enns
Laura Foth
Glen Gray
Sherie Gray
Danielle Harling
Shayna Hjartarson
Michelle Horkoff
Sue Lotocki
Mona Maida
Linda Merry Lambert
Sharon Mohr
Cristabel Nett
Louise Nichol
Teresa Ouellette
Meghan Scarff
Kristel Smith
Marlene Stern
Ted Stevenson
Kaleigh Sullivan
Laura Wisener

2.0 Introduction:

Stroke is a common neurological medical condition. Every year 62,000 Canadians experience a stroke or transient ischemic attack (Hebert et al., 2016) and 405,000 Canadians live with the effects of stroke, with that number projected to increase to between 654,000 and 726,000 by 2038 (Krueger et al., 2015). Stroke impacts an individual's ability to participate in former activities and life roles. Occupational therapists provide assessment and treatment to increase independence in self-care, productivity, and leisure activities, and frequently work with clients recovering from stroke. The literature on stroke rehabilitation is continually evolving; therefore, occupational therapists must be knowledgeable about evidence based practice and apply it within their practice settings.

The Canadian Stroke Best Practice Recommendations (Stroke Rehabilitation Module) were updated in 2015 and published in the International Journal of Stroke in April 2016. The Recommendations were developed to guide rehabilitation in an effort to "increase clinician knowledge, streamline care, reduce practice variations, optimize efficiency and ultimately improve patient outcomes after stroke" (Hebert et al., 2016, p. 3). The upper extremity sections of the Recommendations are of significant value to occupational therapists who frequently work with clients to maximize upper extremity function post stroke. Occupational therapists have noted variations in upper extremity rehabilitation practice between sites and programs in Winnipeg, Manitoba, and have identified the need for increased knowledge to improve the consistency of practice across the stroke rehabilitation continuum of care.

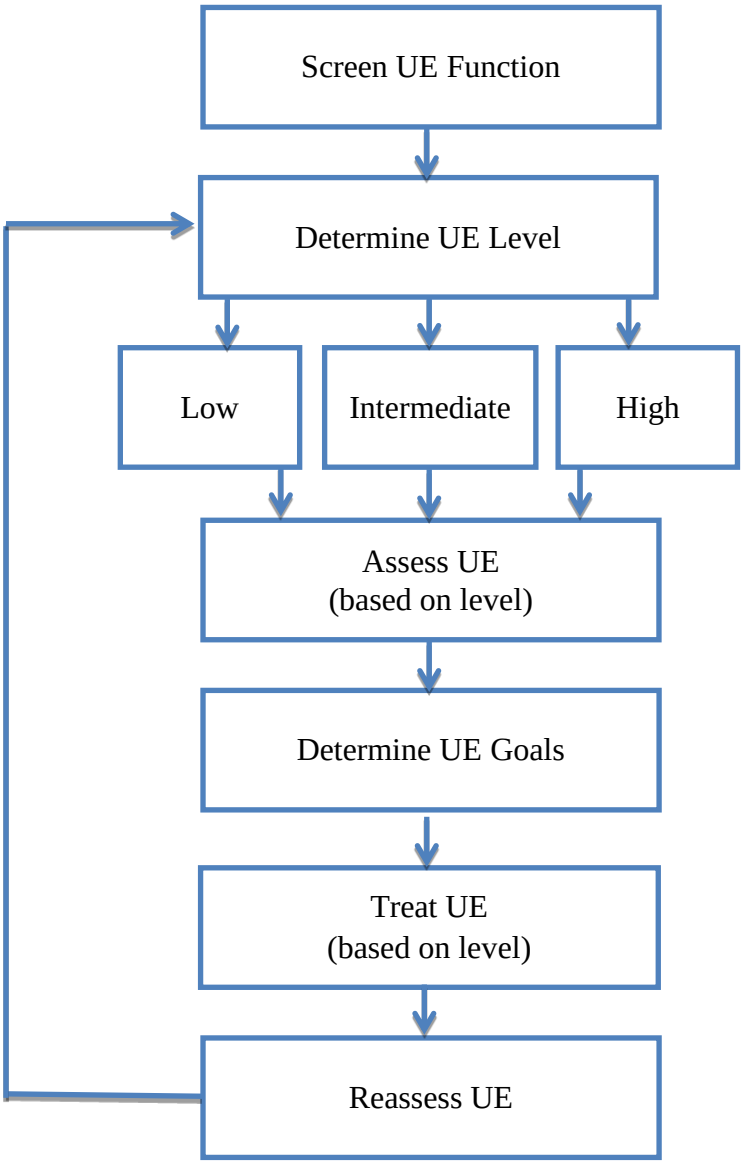
A working group was created in an attempt to consistently implement the upper extremity sections of the Canadian Stroke Best Practice Recommendations into daily clinical practice. A group of occupational therapists from the Winnipeg Health Region collaborated to create a practical Toolkit for occupational therapists working in acute, rehabilitation, outpatient, and community settings. Although this Toolkit was developed specifically for occupational therapists, it is hoped that it will also be of benefit to physiotherapists, rehabilitation assistants, and other healthcare professionals working on upper extremity recovery post stroke. Several occupational therapists and physiotherapists provided feedback throughout various stages of the Toolkit development.

The Toolkit includes: a model for upper extremity management, a list of upper extremity assessment considerations and tools, and a list of specific upper extremity treatments, including practical resources. The Toolkit was informed by the 2013 Canadian Stroke Best Practice Recommendations and the 2013 Evidence Based Review of Stroke Rehabilitation, as well as expertise from Winnipeg occupational therapists across practice settings. The Toolkit was updated after the release of the 2015 Canadian Stroke Best Practice Recommendations (Stroke Rehabilitation Module) and the 2016 update of the Evidence Based Review of Stroke Rehabilitation. The purpose of this Toolkit is to improve the consistency of implementing best practice management of the upper extremity following stroke. It provides information to assist occupational therapists with clinical decision making as they assess, treat and educate clients recovering from stroke. The affected upper extremity has been categorized into low, intermediate or high levels to guide occupational therapists with selecting appropriate assessment tools and treatments. Occupational therapists still need to consider their client's physical status, cognition, perception, affect, and motivation, as well as their physical and social environments when implementing the resources in this Toolkit.

The evidence for upper extremity rehabilitation post stroke continues to emerge. It is critical that occupational therapists are knowledgeable about the most recent evidence as well as the recommendations and resources available to promote optimal upper extremity function throughout the stroke rehabilitation continuum of care.

3.0 A Model for Upper Extremity Assessment and Treatment Post Stroke

A model was developed to illustrate a recommended process for management of the upper extremity (UE) post stroke. This process includes an approach to screening, assessment, and treatment with each step of the model further described in this Toolkit.



4.0 Screening Guidelines:

The Canadian Stroke Best Practice Recommendations 1.ii states: “Initial screening and assessment should be commenced within 48 h of admission by rehabilitation professionals in direct contact with the patient (Evidence Level C)” (Hebert et al., 2016, p. 5).

An initial screen of upper extremity function is crucial at all points of the rehabilitation continuum of care. The screen will determine further assessments required, assist with goal setting, and assist with the choice of specific upper extremity treatments to best promote recovery and prevent complications (e.g. pain, contractures, and edema). The following page is an example of some initial screening questions. Questions should be modified based on the individual client’s presentation.

4.1 Screening Questions:

Determine dominant upper extremity.
Compare affected side to less affected side.

Subluxation:
Feel for shoulder subluxation.
Feel position of scapula on ribcage (both with and without arm movement).

Motor Function:
"Shrug your shoulders toward the ceiling and down."
"Squeeze your shoulder blades together."
"Pretend you are giving someone a hug."
"Raise your arm in front of you to the ceiling." (thumb up)
"Raise your arm to the side." (palm up)
"Put your hand behind your back."
"Put your hand behind your head."
"Touch your chin with your hand. Straighten your elbow."
"Turn your palm up and down." (elbow at 90°)
"Move your wrist up and down."
"With your palm down, move your wrist from side to side."
"Make a fist. Open your hand all the way."
"Squeeze both my hands as hard as you can." (are they equal bilaterally?)
"Touch your thumb to each fingertip slowly."
"Spread your fingers apart and then bring them together."
"Keep your fingers straight while bending them at the knuckles." (metacarpophalangeal joints)

If client is unable to perform the motor tasks as requested above, look at gravity reduced / eliminated positions (e.g. side lying, supine, occupational therapist supporting limb) and/or passive range of motion as appropriate. Observe for changes in tone with movement.

Pain:
"Do you have any pain at rest? Do you have any pain with movement?"
Note pain with passive or active movement.

Sensation:
While rubbing your fingers along the palmar and then the dorsal surfaces of the client's hands and forearms, ask "Does this side feel the same as this?" (compare right and left sides).
"Do you have any numbness or tingling in your arm/hand?"

Edema:
Note edema in fingers, hand or wrist.

Functional Use:
"Do you use your arm throughout the day?"
"Are you able to use your arm for feeding, grooming, washing, dressing, etc.?"
"What activities are you finding difficult to do with your arm/hand?"

5.0 Determining Upper Extremity Level Guidelines:

Upper extremity movement and function varies considerably post stroke. These variations between clients will require the use of different assessment tools and treatments.

The Chedoke-McMaster Stroke Assessment (CMSA) (Gowland et al., 1995) arm and hand sections have been used to help categorize the affected upper extremity into low, intermediate or high levels. These levels can act as a starting point for assessment and treatment planning and can assist occupational therapists with clinical decision making, with the overall goal to progress the client to the next level. The table below can be used to help determine which level a client may best represent. Clients may not "fit cleanly" into a single level (e.g. CMSA hand level 6 with arm level 2). Once the most appropriate level has been determined, occupational therapists should use the corresponding Assessment and Treatment Matrices to guide their therapeutic intervention with the client.

Determinants	Low Level Arm	Intermediate Level Arm	High Level Arm
Chedoke-McMaster Stroke Assessment	▪ Arm stage 1 – 2 ▪ Hand stage 1 – 2	▪ Arm stage 3 – 5 ▪ Hand stage 3 – 5	▪ Arm stage 6 – 7 ▪ Hand stage 6 – 7
Arm Movement and Function	▪ Incompletely selective movements (small amplitude, non-functional) ▪ Primarily used for stabilization tasks	▪ Biomechanical and muscle imbalances with incompletely selective movements ▪ Transitioning from stabilization to manipulation tasks	▪ Selective movements but lacks strength, dexterity, or coordination necessary for "normal" function ▪ Primarily used for manipulation tasks with emphasis on speed, accuracy, and quality of movements

(Adapted from: Stevenson & Thalman, 2007)

6.0 Assessment Guidelines:

The Canadian Stroke Best Practice Recommendations 2.2.iii states: "Clinicians should use standardized, valid assessment tools to evaluate the patient's stroke-related impairments, functional activity limitations, and role participation restrictions and environment [Evidence Level C]. Tools should be adapted for use in patients with communication differences or limitations due to aphasia." (Hebert et al., 2016, p. 9).

There are many upper extremity assessment tools available for use with clients post stroke. After the screening is completed and the upper extremity level has been determined, the following Assessment Matrix can then be used to help occupational therapists determine appropriate assessment tools for their clients.

The intent is not to use all the assessment tools with each client but to choose assessments that will be the most valuable in measuring change in that individual. Assessment tools may vary depending on the availability and relevance to the practice setting.

The assessments listed in the Assessment Matrix are categorized according to their use with low, intermediate and high level upper extremities post stroke. The list is not all-inclusive.

6.1 Assessment Matrix:

Assessment	Low Level Arm	Intermediate Level Arm	High Level Arm
6.1.1 Motor Function	▪ Fugl-Meyer Assessment – Upper Extremity ▪ Functional use in daily activities	▪ Fugl-Meyer Assessment – Upper Extremity ▪ Action Research Arm Test ▪ Chedoke Arm and Hand Activity Inventory ▪ Jebsen Hand Function Test ▪ Wolf Motor Function Test ▪ Functional use in daily activities	▪ Fugl-Meyer Assessment – Upper Extremity ▪ Action Research Arm Test ▪ Chedoke Arm and Hand Activity Inventory ▪ Jebsen Hand Function Test ▪ Wolf Motor Function Test ▪ Functional use in daily activities
6.1.2 Coordination		▪ Box and Block Test ▪ Nine Hole Peg Test ▪ Finger-Nose Test ▪ Rapid Alternating Movement Test	▪ Box and Block Test ▪ Nine Hole Peg Test ▪ Finger-Nose Test ▪ Rapid Alternating Movement Test
6.1.3 Strength	▪ Manual muscle testing	▪ Manual muscle testing ▪ Grip ▪ Pinch (lateral, tripod)	▪ Manual muscle testing ▪ Grip ▪ Pinch (lateral, tripod)
6.1.4 Range of Motion (ROM)	▪ Sitting, side lying, and/or supine: ➢ Active ROM ➢ Active assisted ROM ➢ Passive ROM	▪ Sitting, side lying, and/or supine: ➢ Active ROM ➢ Active assisted ROM ➢ Passive ROM	▪ Sitting and/or standing: ➢ Active ROM
6.1.5 Tone	▪ Modified Ashworth Scale	▪ Modified Ashworth Scale	▪ Modified Ashworth Scale
6.1.6 Pain	▪ Visual Analogue Scale ▪ Chedoke-McMaster Stroke Assessment – Shoulder Pain	▪ Visual Analogue Scale ▪ Chedoke-McMaster Stroke Assessment – Shoulder Pain	▪ Visual Analogue Scale ▪ Chedoke-McMaster Stroke Assessment – Shoulder Pain
6.1.7 Sensation	▪ Light touch / Monofilaments ▪ Hot and cold ▪ Proprioception	▪ Light touch / Monofilaments ▪ Hot and cold ▪ Proprioception ▪ Stereognosis	▪ Light touch / Monofilaments ▪ Hot and cold ▪ Proprioception ▪ Stereognosis
6.1.8 Edema	▪ Circumference ▪ Volume	▪ Circumference ▪ Volume	▪ Circumference ▪ Volume

6.1.1 Motor Function

Fugl-Meyer Assessment – Upper Extremity (FMA-UE):
http://strokengine.ca/assess/module_fma_intro-en.html

Action Research Arm Test (ARAT):
http://strokengine.ca/assess/module_arat_intro-en.html

Chedoke Arm and Hand Activity Inventory (CAHAI):
http://strokengine.ca/assess/module_cahai_intro-en.html
There are four different versions of this assessment tool. Select the version that would be best suited for the client's upper extremity level.

Jebsen Hand Function Test:
http://strokengine.ca/assess/module_jhft_intro-en.html

Wolf Motor Function Test:
http://strokengine.ca/assess/module_wmft_intro-en.html

Functional use in daily activities:
Assess client's ability to spontaneously incorporate their upper extremity into their self-care, productivity and leisure activities.

6.1.2 Coordination

Box and Block Test (BBT):
http://strokengine.ca/assess/module_bbt_intro-en.html

Nine Hole Peg Test (NHPT):
http://strokengine.ca/assess/module_nhpt_intro-en.html

Finger-Nose Test (test for dysmetria):
In sitting, have client move his index finger from his nose to the occupational therapist's index finger (which is placed an arm's length away from client). Record number of repetitions in 10 seconds. Observe quality of movement and compare to less affected side.

Rapid Alternating Movement Test (test for dysdiadochokinesis):
In sitting, have client alternate between supination and pronation arm movements, while his hand is supported on his thigh or on his other hand. Record number of repetitions in 10 seconds. Observe quality of movement and compare to less affected side.

6.1.3 Strength

Manual Muscle Testing:
For manual muscle testing protocols, please see:
Clarkson, H. (2012). *Musculoskeletal assessment: Joint range of motion and manual muscle testing* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins.

Grip Strength:
To reference the manual and standard testing procedure for using a Jamar dynamometer, please see: https://www.chponline.com/store/pdfs/j-20.pdf.

For further information regarding grip strength assessment, please see:
Fess, E. (2011). Functional tests. In T. M. Skirven, A. L. Osterman, J. Fedorczyk, & P. C. Amadio (Eds.), *Rehabilitation of the hand and upper extremity* (6th ed., Vol 1, pp. 152–162). Philadelphia: Elsevier Mosby.

Pinch Strength:
For further information regarding pinch strength assessment, please see:
Fess, E. (2011). Functional tests. In T. M. Skirven, A. L. Osterman, J. Fedorczyk, & P. C. Amadio (Eds.), *Rehabilitation of the hand and upper extremity* (6th ed., Vol 1, pp. 152–162). Philadelphia: Elsevier Mosby.

6.1.4 Range of Motion

For passive and active range of motion measurement protocols, please see:
Clarkson, H. (2012). *Musculoskeletal assessment: Joint range of motion and manual muscle testing* (3rd ed.). Philadelphia: Lippincott Williams & Wilkins.

Goniometry is the preferred method to measure range of motion and should be used to evaluate goals that are targeted towards an increase in range of motion. Range of motion via goniometry must also be used to determine appropriateness for splinting and to measure outcomes of splinting.

6.1.5 Tone

Modified Ashworth Scale:
http://strokengine.ca/assess/module_mashs_intro-en.html

A client's positioning (sitting versus supine) should be consistent over time when measuring tone. It is important to determine and document tonal differences with changes in position and activity. Clinical observations of changes in tone are important.

6.1.6 Pain

"Causes of shoulder pain may be due to the hemiplegia itself, injury or acquired orthopedic conditions due to compromised joint and soft tissue integrity. Shoulder pain may inhibit patient participation in rehabilitation activities, contribute to poor functional recovery and can also mask improvement of movement and function. Hemiplegic shoulder pain may contribute to depression and sleeplessness and reduce quality of life" (Hebert et al., 2016, p. 13).

"The assessment of the painful hemiplegic shoulder should include evaluation of tone, strength, changes in length of soft tissues, alignment of joints of the shoulder girdle, levels of pain and orthopedic changes in the shoulder [Evidence Level C]" (Hebert et al., 2016, p. 13).

It is important to consider the following when assessing pain: a) present at rest and/or with activity, b) specific location, c) quality (e.g. sharp, burning, radiating, etc.), and d) position of the upper extremity. Be sure to differentiate pain from "stretch" and "stiffness". This information will help determine the cause of pain and guide treatment.

Visual Analogue Scale:
There are a variety of visual analogue scales for pain. Ensure you use a consistent scale over time when measuring pain. The following link has several examples of scales:
http://www.painedu.org/Downloads/NIPC/Pain%20Assessment%20Scales.pdf

Chedoke McMaster Stroke Assessment – Shoulder Pain:
http://strokengine.ca/assess/module_cmmsa_intro-en.html

6.1.7 Sensation:

For sensation testing protocols please see:
Cooper, C., & Canyock, J. D. (2013). Evaluation of sensation and intervention for sensory dysfunction. In H. M. Pendleton, & W. Schultz-Krohn (Eds.), *Pedretti's occupational therapy: Practice skills for physical dysfunction* (7th ed., pp. 575-589). St. Louis, MS: Mosby, Inc.

Occupational therapists can consider more in depth sensory assessments, such as:

- Nottingham Sensory Assessment Revised
  http://www.nottingham.ac.uk/medicine/about/rehabilitationageing/publishedassessments.aspx
- Fugl-Meyer Assessment – Upper Extremity (FMA-UE)
  http://strokengine.ca/assess/module_fma_intro-en.html

Monofilaments are the preferred method to objectively measure light touch. For monofilament protocols, please see: http://www.htherapy.co.za/user_images/splinting/Monofilaments.pdf.

Proprioception should also be assessed. For a demonstration of the Thumb Localization Test, a test of proprioception, please see: https://vimeo.com/138227545.

6.1.8 Edema

For descriptions of edema assessment methods, please see:
Kasch, M. C., & Walsh, J. M. (2013). Hand and upper extremity injuries. In H. M. Pendleton, & W. Schultz-Krohn (Eds.), *Pedretti's occupational therapy: Practice skills for physical dysfunction* (7th ed., pp. 1037-1073). St. Louis, MS: Mosby, Inc.

7.0 Goal Setting Guidelines:

It is important to identify goals to assist with planning upper extremity treatment and to determine a client's progress. Goals should be made in collaboration with the client to ensure tasks chosen are meaningful and that the client and the occupational therapist are working toward the same outcomes. "Patients and families should be involved in their management, goal setting and transition planning (Evidence Level A)" (Hebert et al., 2016, p. 11).

The Canadian Occupational Performance Measure (COPM) can be used to help a client identify occupational performance issues, which can then be translated into functional goals. The COPM is a client centered outcome measure that determines change over time in a client's self-perception of their occupational performance issues (Law, Baptiste, Carswell, McColl, Polatajko & Pollock, 2014).

SMART goal setting is a method of setting goals which are: Specific, Measureable, Attainable, Realistic and Time-Based. It clearly identifies a client's goals and clarifies when goal attainment has been achieved. SMART goal setting can be combined with the COPM. A copy of the SMART goals can be provided to the client. Some examples of SMART goals include:

- Client will zip up winter jacket independently with right hand in 2 weeks.
- Client will eat all meals independently with left hand using built up utensils in 4 weeks.
- Client will increase Box and Block Test score to 21 (25%) in 4 weeks.

The following resources may assist with goal setting:

- Canadian Occupational Performance Measure
  http://www.thecopm.ca
- SMART Goals
  https://ehealth.heartandstroke.ca/HeartStroke/HWAP2/Goals.aspx
- "Goal Setting 101"
  http://canadianstrokenetwork.ca/en/wp-content/uploads/2014/08/GettingOn-EN.pdf

8.0 Treatment Guidelines:

The Canadian Stroke Best Practice Recommendations 5.1.A states: "Patients should engage in training that is meaningful, engaging, repetitive, progressively adapted, task-specific and goal-oriented in an effort to enhance motor control and restore sensorimotor function [Evidence Level: Early-Level A; Late-Level A]. Training should encourage the use of patients' affected limb during functional tasks and be designed to simulate partial or whole skills required in activities of daily living . . . [Evidence Level: Early-Level A; Late-Level A]" (Hebert et al., 2016, p. 11).

"All patients with stroke should receive rehabilitation therapy as early as possible once they are determined to be rehabilitation ready and they are medically able to participate in active rehabilitation (Evidence Level A), within an active and complex stimulating environment (Evidence Level C)" (Hebert et al., 2016, p. 9).

There are many options available for upper extremity treatment post stroke. Based on the upper extremity screening and assessment results as well as the client's goals, specific treatments should be chosen that best suit the client's upper extremity level. Treatment activities should be task specific, meaningful to the client, and easily graded so optimal challenge can be maintained. Specific treatments may vary depending on availability and relevance to the practice setting. In all practice settings, the client's body position and trunk stability as well as the environmental set-up need to be considered to maximize upper extremity function. It is also important to educate the client regarding the purpose of the specific treatments being used. Education may enhance client engagement in the treatment process which may then contribute to improved outcomes.

Although the optimal goal of upper extremity rehabilitation is to promote motor recovery and function of the affected upper extremity, at times assistive devices and compensatory strategies may need to be incorporated temporarily to enable participation. It is important to note that compensatory behavioral changes "can also be maladaptive and interfere with improvements in function that could be obtained using rehabilitative training" (Kleim & Jones, 2008, p. S226); therefore, early instruction in compensatory strategies may be detrimental to learning new skills with the affected arm and interfere with improvements in function that could be obtained through upper extremity rehabilitation. The Canadian Stroke Best Practice Recommendations 5.1.C.i states: "Adaptive devices designed to improve safety and function may be considered if other methods of performing specific functional tasks are not available or tasks cannot be learned [Evidence Level C]" (Hebert et al., 2016, p. 12). Compensatory strategies and the use of equipment should be frequently re-evaluated and weaned as appropriate.

The specific treatments listed in the Treatment Matrix are categorized according to their use with low, intermediate and high level upper extremities post stroke. The list is not all-inclusive. Practical tools are included for several treatments identified in the Treatment Matrix.

8.1 Treatment Matrix:

8.1.1 Task specific training, "the repeated, challenging practice of functional, goal-oriented activities" (Lang & Birkenmeier, 2014, p. xi), should be utilized with all treatment modalities. Occupational therapists should strive for increased intensity and number of repetitions of upper extremity use. The optimal number of repetitions is unknown; however, studies suggest that "hundreds of repetitions of task-specific practice may be required to optimize function post stroke" (Birkenmeier, Prager, & Lang, 2010, p. 620).

Specific Treatments	Low Level Arm	Intermediate Level Arm	High Level Arm
8.1.2 Constraint Induced Movement Therapy (CIMT)	▪ Work toward minimal active movement requirements for CIMT program	▪ Work toward minimal active movement requirements for CIMT program	▪ Refer to traditional or modified CIMT program as available ▪ Provide individual program based on CIMT principles
8.1.3 Functional Dynamic Orthoses (e.g. SaeboFlex, SaeboReach, SaeboGlove)	▪ Work toward minimal active and passive movement requirements for functional dynamic orthosis	▪ Use functional dynamic orthosis (SaeboFlex or SaeboReach) for daily sessions, followed by functional activities without orthosis ▪ Use functional dynamic orthosis (SaeboGlove) during daily activities	▪ Wean from functional dynamic orthosis
8.1.4 Functional Electrical Stimulation (FES)	▪ Target wrist extensor and forearm muscles while engaged in task specific activities ▪ Consider using to reduce or prevent shoulder subluxation	▪ Target wrist extensor and forearm muscles while engaged in task specific activities	
8.1.5 Mental Imagery	▪ Use as an adjunct to other treatments ▪ Use as homework	▪ Use as an adjunct to other treatments ▪ Use as homework	▪ Use as an adjunct to other treatments ▪ Use as homework

8.1 Treatment Matrix (continued)

Specific Treatments	Low Level Arm	Intermediate Level Arm	High Level Arm
8.1.6 Joint Protection and Supports	▪ Educate regarding handling and joint protection when sitting, lying, and mobilizing ▪ Use slings with caution and only with frequent re-evaluation to ensure active movement is not restricted and tone is not increasing ▪ Assess need for custom or pre-fabricated splint to assist with positioning	▪ Wean slings and/or positioning splints ▪ Consider splint to facilitate functional activities ▪ Consider shoulder girdle taping	▪ Consider shoulder girdle taping
8.1.7 Spasticity Management	▪ Refer to physiatrist / spasticity clinic for medical management if required ▪ Strengthen antagonist muscles post-injection ▪ Assess need for custom or pre-fabricated splint to maintain prolonged stretch ▪ Progress active movement	▪ Refer to physiatrist / spasticity clinic for medical management if required ▪ Strengthen antagonist muscles post-injection ▪ Progress active movement	▪ Refer to physiatrist / spasticity clinic for medical management if required ▪ Strengthen antagonist muscles post-injection ▪ Progress active movement
8.1.8 Supplementary Training Programs	▪ Use portions of Level 1 of Graded Repetitive Arm Supplementary Program (GRASP) ▪ Provide individualized home program with daily homework book	▪ Use Levels 1-3 of GRASP ▪ Provide individualized home program with daily homework book	▪ Provide individualized home program with daily homework book
8.1.9 Mirror Therapy	▪ Use as an adjunct to other treatments ▪ Use as homework	▪ Use as an adjunct to other treatments ▪ Use as homework	
8.1.10 Sensory Stimulation and Re-training	▪ Implement protective sensation teaching ▪ Encourage weight bearing positions ▪ Encourage use of vision during functional activities	▪ Encourage use in functional activities ▪ Transition from use of vision during functional activities to activities with vision occluded as safety permits	▪ Encourage use in functional activities ▪ Advance to activities with vision occluded as safety permits

8.1 Treatment Matrix (continued)

Specific Treatments	Low Level Arm	Intermediate Level Arm	High Level Arm
8.1.11 Range of Motion (ROM) and Strength Training	▪ Maintain / increase ROM through: ➢ Facilitation of active movement by therapist ➢ Progression from bilateral to unilateral activities ➢ Active assisted ROM in sitting, supine, or gravity reduced positions ➢ Passive ROM ➢ Self-ROM ▪ Use strength training through available ROM including use of mobile arm support as indicated ▪ Do not use pulleys	▪ Maintain / increase ROM through: ➢ Active ROM while providing verbal and/or tactile cueing ➢ Progression from bilateral to unilateral activities ➢ Active assisted ROM in sitting, supine, or gravity reduced positions ➢ Passive ROM ➢ Self-ROM ▪ Use strength training through available ROM ▪ Do not use pulleys	▪ Maintain / increase ROM through: ➢ Active ROM while providing verbal and/or tactile cueing ▪ Use strength training through available ROM ▪ Monitor carefully if using pulleys
8.1.12 Edema Management	▪ Encourage active, active-assisted and passive movement ▪ Consider retrograde massage ▪ Educate regarding positioning and elevation ▪ Use compression techniques ▪ Assess need for custom or pre-fabricated splint	▪ Encourage active movement ▪ Consider retrograde massage ▪ Educate regarding positioning and elevation ▪ Use compression techniques	▪ Encourage active movement ▪ Consider retrograde massage ▪ Educate regarding positioning and elevation ▪ Use compression techniques
8.1.13 Virtual Reality	▪ Use as an adjunct to other treatments ▪ Use as homework	▪ Use as an adjunct to other treatments ▪ Use as homework	▪ Use as an adjunct to other treatments ▪ Use as homework

8.1.1 Task Specific Training Guidelines:

- Choose engaging tasks based on client's goals that will translate into self-care, productivity, and leisure activities.
- Repetition is important. "Massed practice (several hours of exercise) of the affected arm" (Sirtori, Corbetta, Moja, & Gatti, 2009, p. 2) should be encouraged.
- Can refer to it as "rehearsing a task", do it over and over again, making little corrections each time until the movement gets smoother.
- The "task" should be simple but still hard enough to challenge the client and encourage active problem solving.
- Consider use of an arm activity list (see pages 21 and 22 – Arm Activity List A could be appropriate for a low-intermediate level arm; Arm Activity List B could be appropriate for an intermediate-high level arm).
- Homework sheets should be provided and reviewed with clients (see examples on pages 23, 24 and 25 – Homework A for low level arm; Homework B for intermediate level arm; Homework C for high level arm).
- Consider use of a journal with tasks to be done each day.
- Consider use of a treatment contract (see page 26) to encourage accountability.

(Adapted from: Harley, 2013)

Examples of tasks for each upper extremity level:

Low Level:

- Encourage weight bearing during activities of daily living.
- Work on bilateral grasp, e.g. drink from bottle, eat finger food, wash face, etc.
- Use the affected upper extremity as a stabilizer:
  - Against the body (or a table), e.g. carry clothes to hamper, hold purse while taking wallet out, carry newspaper against chest.
- Use the affected hand as a stabilizer:
  - To "hold" objects in hand (gross grasp or pinch), e.g. hold a water bottle to open it, hold a toothbrush while applying toothpaste with the other hand, hold a container of food while eating with the other hand.

Intermediate Level:

- Use the affected upper extremity as much as possible, e.g. eat finger food, use utensils (build up as needed), pour water, stack/wash dishes, brush hair, wring out washcloths, do up zippers, fold towels, turn pages, etc.
- Teach lateral pinch (thumb over index PIP joint) e.g. hold bottom of zipper, hold envelope while opening. Concentrate on release of pinch before taking object from hand.
- Focus on ulnar component of grasp and maintaining wrist extension during grasp/release of daily objects.

High Level:

- Focus on individual goals.
- Make the intermediate tasks harder, focus on isolating movements, e.g. practice keyboarding, practice handwriting, use calculator, etc.
- Work on in-hand manipulation, e.g. separate coins, wring out washcloths, etc.
- Increase intensity and number of repetitions.
- Encourage use of affected upper extremity as much as possible in all daily tasks.
- Practice thumb work, e.g. pick up coins, use remote control, practice texting, use flashlight, etc.

ARM ACTIVITY LIST A

Name: _____

Add a new activity every day / week.
"2 hands" refers to interlocking grip as needed.
"Under arm" refers to holding item between upper arm and side of body.

Position hand on table in view	_____	Hold food with fork when cutting	_____
Hold toothpaste	_____	Carry a newspaper (under arm)	_____
Hold deodorant	_____	Carry a towel (under arm)	_____
Pull up blankets (2 hands)	_____	Carry a purse / wallet (under arm)	_____
Use call bell	_____	_____	_____
Pick up water bottle (2 hands)	_____	_____	_____
Eat finger food (2 hands)	_____	_____	_____
Hold washcloth	_____	_____	_____
Wash face (2 hands)	_____	_____	_____
Brush teeth (2 hands)	_____	_____	_____
Hold towel with hand	_____	_____	_____
Dry self (2 hands)	_____	_____	_____
Wipe table	_____	_____	_____
Hold paper down when writing	_____	_____	_____
Hold bowl/plate when eating	_____	_____	_____
Apply wheelchair brakes	_____	_____	_____
Use a fork / spoon to eat	_____	_____	_____

Occupational Therapist: _____ Phone: _____

(Adapted from: Thalman, 2002)

ARM ACTIVITY LIST B

Name: _____

Add a new activity every day / week.

Fill out menu	_____	Put on shoes	_____
Use call bell	_____	Put on socks	_____
Pull up covers	_____	Pour liquids	_____
Turn on light switches	_____	Use fork	_____
Drink from a cup	_____	Use spoon	_____
Eat finger food	_____	Use knife	_____
Turn pages in a book / magazine	_____	Hold phone while talking	_____
Brush teeth	_____	Dial phone	_____
Brush hair	_____	Open fridge	_____
Turn on / off faucets	_____	Use computer mouse / keyboard	_____
Wash self with washcloth	_____	Practice handwriting	_____
Flush toilet	_____	Open doors	_____
Wipe self	_____	Unload dishwasher	_____
Pull pants up and down	_____	Put away groceries	_____
Do up zippers / buttons	_____	_____	_____
Wipe table	_____	_____	_____
Take clothes out of closet / drawer	_____	_____	_____
Hang up clothes	_____	_____	_____

Occupational Therapist: _____ Phone: _____

(Adapted from: Thalman, 2002)

Name: _____

HOMEWORK A

Try to include your arm in as many tasks as possible to give the muscles an opportunity to "turn on". Please do these exercises **2-3 times a day**. If something hurts, STOP what you are doing and discuss with your therapist.

Lying in bed (on back):

1. "Push" both your shoulder blades and elbows down into the bed. Relax. Repeat 10 times.

2. "Push" your hand down into the bed. Relax. Repeat 10 times.

3. Interlock the fingers of both your hands. Raise your hands to the side of your head and make a "chopping" motion across your body. Repeat 10 times each direction.

Sitting up:

1. Place your hand flat on a pillow (or arm board if you have). "Push" down onto your forearm and hand. Relax. Repeat 10 times.

2. "Wash" the table top using a washcloth, back and forth and side to side. Use your other hand to help if needed. Repeat for 2 minutes.

3. Interlock the fingers of both your hands
   a) Reach for and grasp a plastic bottle or other container. Bring it to your chin, then return to the table and let go **each** time. Repeat 8 times.
   b) Eat finger foods with your fingers interlocked.
   c) Take a washcloth in both hands. Rub over your entire face (you can do it with a wet or dry cloth). Place on your lap and LET IT GO. Pick it up again and repeat 5 times.

4. Place a towel in your armpit. Try to press your arm to your body to keep it there, while your other hand tries to pull it out. Repeat 10 times.

5. Use your hand to hold a plastic bottle. Open the bottle with your stronger hand, then attempt to let go of the bottle with your weaker hand. Relax. Repeat 8 times.

6. Bring both your shoulders to your ears. Relax. Repeat 10 times.

Occupational Therapist: _____ Phone: _____

Name: _____

HOMEWORK B

Use your hand as much as possible with everyday activities such as eating finger food, brushing your hair, washing your face, etc. Try the activities first with your weaker hand, only using the stronger hand AFTER you have tried a few times. Please do these exercises **at least 2-3 times a day**. If something hurts, STOP what you are doing and discuss with your therapist.

Lying in bed (on back):

1. "Punch" your hand up toward the ceiling. Control it all the way up and down. Repeat 10 times.

2. Bring your hand up to your chin then slowly lower beside you. Repeat 10 times.

3. Grasp the blankets with your hand and pull them up to your chin, then over your head if you can. Push them back down to your waist and let go. Repeat 10 times.

Sitting up:

1. Grasp a washcloth, bring it to your chin, and then return it to your lap/table and let go. Repeat 10 times. Do the same with a water bottle and repeat 10 times.

2. Place a variety of items on a table (bottle, brush, washcloth, pen, phone, utensils, etc). Grasp each item and then let go of it on your lap or bed. Make sure you let go of each item as smoothly as possible. Repeat each item twice.

3. Turn pages in a magazine. If you are not able to turn one page at a time, turn several pages at a time. Repeat from start to finish.

4. Try holding a pen (build up the handle if need be) and color in shapes across a page. They can be circles, squares, triangles, etc.

5. Hold your arms out to your side, and then clap your hands in front of you, keeping your arms straight. Make sure you hear a "clap" sound. Repeat 10 times.

6. Pretend to "punch" with your arm. Make sure to punch to the left, in front of you and to the right. Repeat 3 times each direction.

Occupational Therapist: _____ Phone: _____

Name: _____

HOMEWORK C

Use your hand for EVERYTHING! Repeat these exercises **at least 4-5 times a day.** If something hurts, STOP what you are doing and discuss with your therapist.

1. Hold a pen at the bottom. Work your fingertips up the pen to the top, and then back down slowly. Repeat 10 times.

2. While holding a remote or phone in your hand, take your thumb and touch each outside button once, slowly. Make sure you are moving your weaker hand without help from your stronger hand. Repeat 2 times.

3. Place 5 different coins on a table. Pick them up one at a time and place them into your palm. Slowly take them out in order of amount, one at a time, using your thumb and index finger. Repeat 3 times.

4. Handwriting (as appropriate) - do one paragraph a day in the same notebook to compare your progress.

5. Place 3 washcloths in a basin or sink filled with water. Take one washcloth out at a time, squeezing as much water out as possible, using only your weaker hand to turn the cloth in your hand to change the grip. Repeat 2 times.

6. Tap a balloon in the air for 3 minutes keeping track of how many taps you are able to get in a row. Try to increase the height of the balloon to make it harder. (You can do this one with a partner too.)

Occupational Therapist: _____ Phone: _____

Treatment Contract

I agree to perform all homework, as developed with my occupational therapist(s) to the best of my ability. I agree to keep a record in my homework book and bring it to all therapy appointments.

The goals we have agreed to work on until _____ are as follows:
(dd/mm/yy)

1. _____
2. _____
3. _____

_____	_____	_____
Client	Occupational Therapist	Date

8.1.2 Constraint Induced Movement Therapy

The Canadian Stroke Best Practice Recommendations 5.1.B.iv states: "Traditional or modified constraint-induced movement therapy (CIMT) should be considered for a select group of patients who demonstrate at least 20 degrees of active wrist extension and 10 degrees of active finger extension, with minimal sensory or cognitive deficits (Evidence Level: Early-Level A; Late-Level A) (Hebert, 2016, p. 12).

"CIMT can be described as either: a) Traditional CIMT: 2-week training program, with 6 hours of intensive upper-extremity training with restraint of the unaffected arm for at least 90% of waking hours. b) Modified CIMT: often refers to less intense than traditional CIMT, with variable intensity, time of constraint and duration of program" (Teasell & Hussein, 2016, p. 7 & 8).

Principles of CIMT:

- Use the more affected upper extremity in frequent, intense, massed practice tasks.
- Adapt the tasks for optimal challenge.
- Use consistent "coaching" of client by occupational therapist, rehabilitation assistant or trained family member (as able).
- Constrain the less affected upper extremity with a mitt or splint for up to 90% of waking hours (as negotiated between client and occupational therapist).
- Focus on transfer of skills to daily tasks (use of treatment contract and homework).

For information regarding the CIMT program in Winnipeg, please contact the Health Sciences Centre Occupational Therapy Department at 204-787-2786. Prior to acceptance into a CIMT program or in the absence of a formal CIMT program, occupational therapists should incorporate CIMT principles into a client's daily therapy sessions and home programs as early as possible.

8.1.3 Functional Dynamic Orthoses

The Canadian Stroke Best Practice Recommendations 5.1.c.iii states: “Functional dynamic orthoses are an emerging therapy tool that may be offered to patients to facilitate repetitive task specific training [Evidence Level B]” (Hebert et al., 2016, p. 12).

Using a dynamic wrist hand orthosis, that positions the wrist and hand functionally and assists with finger / thumb extension (e.g. SaeboFlex or SaeboReach), may enable participation in repetitive task oriented activities not otherwise possible. After the orthosis is removed in the daily training sessions (with goal of two 45 minute sessions per day), continued use of the upper extremity in grasp / release and functional activities is recommended.

Some functional dynamic orthoses, for those with minimal spasticity, can be worn for longer periods of time during daily activities (e.g. SaeboGlove).

For eligibility criteria and information on Saebo functional dynamic orthoses, please see http://www.saebo.com/.

Handouts are being developed to assist with screening for, assessing and treating with the SaeboFlex and SaeboReach orthoses. These handouts are based on the Saebo arm training program guidelines. Occupational therapists must be trained in order to prescribe and use Saebo orthoses with their clients. Trained occupational therapists can contact the Toolkit authors for Saebo handout information.

8.1.4 Functional Electrical Stimulation

The Canadian Stroke Best Practice Recommendations 5.1.B.iii states: "Functional Electrical Stimulation (FES) targeted at the wrist and forearm muscles should be considered to reduce motor impairment and improve function [Evidence Level: Early-Level A; Late-Level A]" (Hebert et al., 2016, p. 12).

The Canadian Stroke Best Practice Recommendations 5.3.A.ii states: "For patients with a flaccid arm (i.e., Chedoke-McMaster Stroke Assessment < 3) electrical stimulation should be considered [Evidence Levels: Early- Level B; Late- Level B]" (Hebert et al., 2016, p. 13).

The Evidence-Based Review of Stroke Rehabilitation states: "There is level 1a and level 2 evidence that FES/NMES may improve upper limb motor function, range of motion, and manual dexterity when offered in combination with conventional therapy or delivered alone in subacute stroke. The evidence is also indicative of a beneficial effect on range of motion and manual dexterity when FES/NMES was offered to chronic stroke patients either alone or in combination with other therapies. Despite improvements in both stages of stroke recovery, level 1b evidence indicates that delivering FES early (< 6 months) may be more beneficial at recovering impaired motor function than delivering FES after 6 months post-stroke" (Foley et al., 2016, p. 88).

FES should be combined with task specific treatment activities whenever possible.
Some examples of treatment activities to combine with FES of the wrist extensors are:

- Use the back of the hand to move a cup from one place to another on a table.
- Wrap the hand around a cup when the muscle stimulation is off; let go of the cup when the muscle stimulation is on.
- Work on sit to stand using both arms on armrests of a chair. When the muscle stimulation comes on, work on straightening wrist and pushing into standing position.
- Use with the SaeboFlex orthosis to facilitate wrist / finger extension during the release of therapy balls, water bottle, cup, etc.

Some examples of treatment activities to combine with FES of the shoulder girdle are:

- Perform shoulder shrugs when the muscle stimulation is on.
- Place hand on ball or pillow beside body and push down when the muscle stimulation is on.

Prior to providing this intervention, occupational therapists need to be trained regarding the use, protocols and contraindications for functional electrical stimulation.

8.1.5 Mental Imagery

The Canadian Stroke Best Practice Recommendations 5.1.B.ii states: "Following assessment to determine if they are suitable candidates, patients should be encouraged to engage in mental imagery to enhance upper-limb, sensorimotor recovery [Evidence Level: Early-Level A; Late-Level B]" (Hebert et al., 2016, p. 12).

Page (2001) states: ". . . mental practice is a technique by which CVA patients can simulate repeated practice using the affected arm. In so doing, activations occur as if the arm were actually being utilized, which may restore some level of function in patients' affected limbs" (p. 60).

Patients may have greater or lesser ability to perform mental imagery training, post stroke, depending on the area of the brain affected. Patients with parietal lobe damage may have difficulty performing mental imagery, as may patients with frontal lobe and basal ganglia involvement (McInnes, 2016).

Mental imagery is best done in a quiet environment so distractions are minimized. The client can be instructed in progressive muscle relaxation techniques, which can be done prior to the mental imagery to improve focus. Imagery is often done either immediately before or after practicing actual movements of the affected upper extremity. The client can be instructed to imagine all the steps of a successful functional activity. The affected upper extremity should be placed in the correct position for the start of the movement that is to be imagined. The occupational therapist provides specific written instructions or a voice recording describing the activity to be imagined, including the specific upper extremity movements required to complete the task, the number of repetitions or the duration of the activity. Mental imagery can be done several times a day. The imagery script should be graded as the client improves.

Mental imagery scripts can be composed for many different activities depending on the client's goals. Examples include:

- Picking up a pen and positioning it in the hand for writing
- Reaching for a towel and drying the other arm with it
- Grabbing a tissue and bringing it up to the nose
- Squeezing water out of a washcloth
- Wiping a counter with a towel
- Using a knife to spread peanut butter onto bread
- Throwing a ball

For an example of a mental imagery script, see page 31.

Mental Imagery Sample Script:

Activity: Reaching for a Cup

Today we are going to imagine that you are reaching for a cup that is sitting on a table in front of you. The cup is half full with water.

- See yourself sitting up tall in an armchair with your arm on the armrest.
- Bring your arm forward slowly toward the table in front of you.
- Straighten your elbow as you reach for the cup.
- Open your fingers and thumb as your hand approaches the cup on the table.
- Think about opening your fingers and thumb just wide enough to go around the cup.
- Grasp the cup gently between your fingers and thumb.
- Squeeze your fingers and thumb hard enough to lift the cup slightly off the table without spilling it.

Repeat this imagery task 10 times before moving onto the next imagery task.

8.1.6 Joint Protection and Supports

The Canadian Stroke Best Practice Recommendations 5.3.A.i states: "Joint protection strategies should be used during the early or flaccid stage of recovery to prevent or minimize shoulder pain. These include: a) Positioning and supporting the arm during rest [Evidence Level B]. b) Protecting and supporting the arm during functional mobility [Evidence Level C]. c) Protecting and supporting the arm during wheelchair use by using a hemi-tray or arm trough [Evidence Level C]…" (Hebert et al., 2016, p. 13).

8.1.6a Positioning and Supporting the Arm in Lying and in Sitting

The Canadian Stroke Best Practice Recommendations 5.3.A.v states: "Healthcare staff, patients and family should be educated to correctly handle the involved arm [Evidence Level A]. For example, careful positioning and supporting the arm during assisted moves such as transfers; avoid pulling on the affected arm [Evidence level C]" (Hebert et al., 2016, p. 13).

The Evidence-Based Review of Stroke Rehabilitation states: "The muscles around the hemiplegic shoulder are often paralyzed, initially with flaccid tone and later with associated spasticity. Careful positioning of the shoulder serves to minimize subluxation and later contractures as well as possibly promote recovery, while poor positioning may adversely affect symmetry, balance and body image" (Cotoi et al., 2016, p.15).

Optimal positioning in lying and sitting should maximize pain free degrees of shoulder abduction and external rotation while maintaining shoulder joint alignment.

For an example of bed and chair positioning handouts, see pages 33 and 34.

CLIENT'S NAME:_____ Affected side (shaded): **RIGHT**

BED & CHAIR POSITIONING FOLLOWING A STROKE

Lying on affected side**

- Position affected shoulder so that shoulder blade lies flat and arm appears slightly forward from trunk
- Place unaffected leg forward on one or two pillows
- Place a pillow behind back and ensure that they are not lying directly on hip bone

Lying on unaffected side

- Position affected shoulder forward with arm supported on pillow
- Place pillow(s) between legs
- Place a pillow behind back and ensure that they are not lying directly on hip bone

Lying on back (if desired)

- Place pillow behind affected shoulder blade
- Place affected hand on pillow above heart level
- Place pillow beneath affected hip and/or beneath both knees (optional)

Sitting up

- Ensure client sits well back in the centre of chair or wheelchair
- Place arms well forward onto two pillows on table or arm board if available
- Ensure feet are flat on floor or footrests

ENSURE THAT YOU ASK CLIENT "ARE YOU COMFORTABLE?"

If you have any questions, please contact your Occupational Therapist or Physiotherapist

Name: _____ **Phone:**_____

(Adapted from: Chest Heart and Stroke Scotland, 2012)

CLIENT'S NAME: _____ **Affected side (shaded): LEFT**

BED & CHAIR POSITIONING FOLLOWING A STROKE

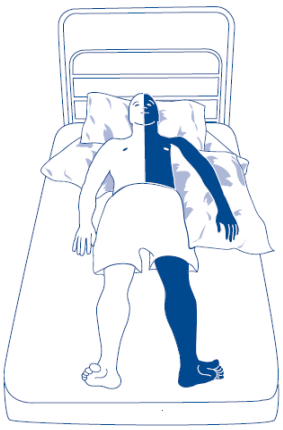
Lying on affected side**

- Position affected shoulder so that shoulder blade lies flat and arm appears slightly forward from trunk
- Place unaffected leg forward on one or two pillows
- Place a pillow behind back and ensure that they are not lying directly on hip bone

Lying on unaffected side

- Position affected shoulder forward with arm supported on pillow
- Place pillow(s) between legs
- Place a pillow behind back and ensure that they are not lying directly on hip bone

Lying on back (if desired)



- Place pillow behind affected shoulder blade
- Place affected hand on pillow above heart level
- Place pillow beneath affected hip and/or beneath both knees (optional)

Sitting up

- Ensure client sits well back in the centre of chair or wheelchair
- Place arms well forward onto two pillows on table or arm board if available
- Ensure feet are flat on floor or footrests

ENSURE THAT YOU ASK CLIENT "ARE YOU COMFORTABLE?"

If you have any questions, please contact your Occupational Therapist or Physiotherapist

Name: _____ **Phone:** _____

(Adapted from: Chest Heart and Stroke Scotland, 2012)

8.1.6b Positioning and Supporting the Arm during Transfers and Mobility

The Canadian Stroke Best Practice Recommendations 5.3.A.d states: "The use of slings remains controversial beyond the flaccid stage, as disadvantages outweigh advantages (such as encouraging flexor synergies, discouraging arm use, inhibiting arm swing, contributing to contracture formation, and decreasing body image) (Evidence Level C)" (Hebert et al., 2016, p. 13).

The Evidence-Based Review of Stroke Rehabilitation states: "….a sling remains the best method of supporting the flaccid hemiplegic arm while the patient is standing or transferring. Ada et al. (2005a) conducted a systematic Cochrane review evaluating the benefit of shoulder slings and supports, and concluded that there is insufficient evidence that these devices reduce or prevent shoulder subluxation following a stroke" (Cotoi et al., 2016, p. 16).

It is important that all positioning and supportive devices are evaluated each visit and that a client is not discharged from an occupational therapist's caseload without a plan in place for re-evaluation.

If a sling is required for short term use during ambulation and transfers, occupational therapists should provide education regarding the purpose of the sling, donning methods, potential benefits and risks of use, and the plan for monitoring use of and discontinuation of the sling. To determine if a client may benefit from a sling for short term use, see page 36.

For information on various upper extremity positioning devices, see page 37.

Sling Me?

If other options for supporting the upper extremity have been ruled out, a sling could be used. Slings should **NEVER** be left on while in bed or sitting up. Slings are **NOT** for long-term use and need to be continually **REASSESSED**. The following checklist may help determine if a sling is truly the best option for supporting the upper extremity.

	YES	**NO**
Decreased Tone		
Acute Edema		
Acute Pain		
Decreased sensation / perception / cognition (risk of trauma)		
Less than 10 degrees of active shoulder movement in any plane		
Caregivers need reminder to not pull on arm		

(Adapted from: Thalman, 2008)

If you have multiple "yes" responses, you could consider providing a sling short-term, then re-evaluate at **each visit**. Sling use can lead to pain as well as decreased passive and active range of motion due to immobilization. There is insufficient evidence for the use of slings solely for the prevention or reduction of subluxation. A client **SHOULD NOT** be discharged from caseload with a sling without a plan for immediate follow-up by an occupational therapist.

If a sling is being used only to remind caregivers not to pull on a client's affected upper extremity, consider use of a brightly colored arm or wrist band and provide education to caregivers.

Positioning Devices

Positioning Devices	Pros	Cons
Arm Boards (half lap tray or arm trough)	▪ Protects and supports a low tone upper extremity during wheelchair use ▪ Places upper extremity in view of client ▪ Hand is "free" for functional activity	▪ Upper extremity may be at risk of trauma secondary to falling off of the arm board; strapping is not advised due to possibility of impingement ▪ Requires height adjustable armrests on a wheelchair to obtain ideal position
GivMohr Sling	▪ Distal support promotes weight bearing	▪ Hand is not "free" for functional activity ▪ Hand piece can be uncomfortable ▪ Hand piece may cause skin breakdown ▪ Difficult to don/doff independently
Omo Neurexa Sling (Otto Bock)	▪ Hand is "free" for functional activity	▪ May reinforce dependent edema of upper extremity ▪ Difficult to position sling for optimal shoulder joint position (e.g. humeral head elevation) ▪ Difficult to don/doff independently
Hemi Sling		▪ Hand is not "free" for functional activity ▪ Encourages flexor synergy patterns ▪ Contributes to the development of contractures ▪ Restricts active and passive movement ▪ Inhibits arm swing ▪ May impact functional balance and ambulation ▪ Difficult to don/doff independently
Other (e.g.: pocket, belt, shoulder bag, waist pouch)	▪ Low cost ▪ Readily available ▪ Easy transition from support to functional use of arm	▪ Trial and error for optimal support and position

8.1.6c Positioning and Supporting the Hand

The Canadian Stroke Best Practice Recommendations 5.2.i states: "Spasticity and contractures may be prevented or treated by antispastic pattern positioning, range-of-motion exercises, and/or stretching [Evidence Levels: Early- Level C; Late-Level C]. Routine use of splints is not recommended in the literature [Evidence Levels: Early-Level A; Late-Level B); however, optimal protocols for utilizing splinting for improvement or preservation of tissue length and spasticity management have not yet been determined. In some select patients, the use of splints may be useful and should be considered on an individualized basis (Evidence Level C). A plan for monitoring the splint for effectiveness should be provided (Evidence Level C)" (Hebert et al., 2016, p. 12).

Occupational therapists should assess each client individually to determine if splinting would be beneficial to promote function, manage spasticity, prevent contracture, and/or assist with positioning for pain and/or edema management. Splinting should always be seen as an adjunct to active task practice and movement retraining. As with any treatment intervention, clear goals should be documented and outcome measurement should occur (College of Occupational Therapists & Association of Chartered Physiotherapists in Neurology, 2015).

The goal of splinting "should be about maintaining the improvement of range of motion and soft tissue integrity" (Bondoc & Harmeyer, 2013, p. 11). "If muscles are biomechanically imbalanced, and soft tissues shortened, functional motor recovery will be very challenging for the client" (Bondoc & Harmeyer, 2013, p. 12).

Splinting Considerations:

- "For acute stroke survivors, 35° of wrist extension with MCP's, PIP's and DIP's in neutral" is recommended (Saebo Inc., 2013, p. 37).

- "For chronic stroke survivors, start with the wrist in flexion and finger joints in neutral. Passively extend the wrist until resistance is felt (fingers begin to curl). This is the initial wrist position for splinting ("catch one" or resistance, R1)" (Saebo Inc., 2013, p. 37). "The wrist may be extended to a greater angle as long as the digits are maintained in composite extension to achieve optimal stretch of the wrist and finger flexors" (Bondoc & Harmeyer, 2013, p. 11).

- The thumb should be positioned "in abduction and extension" (Bondoc & Harmeyer, 2013, p.11).

- Occupational therapists should monitor for tingling in the fingers (thumb, index, middle and ring fingers) if splinting the wrist in flexion, as the median nerve may be compressed. If median nerve compression neuropathy occurs, wrist may need to be moved out of flexed position, sacrificing finger extension.

- Occupational therapists should "constantly monitor the progression of the client's hand by evaluating the range of motion, soft tissue and joint play, and the type of volitional control the client has regained" (Bondoc & Harmeyer, 2013, p. 11). Occupational therapists should also monitor skin integrity.

- Occupational therapists should consider splinting with a flexible material that allows fingers to move through flexion with increases in tone (e.g. Aquaplast 3/32), in order to provide a stretch to the long finger and wrist flexors while maintaining joint integrity.

- Serial splinting could be used to progressively increase range of motion (e.g. elbow, forearm, wrist and/or fingers).

- Splinting that provides joint support to facilitate function may also be considered (e.g. opponens splint or dorsal wrist cock-up splint) (Bondoc & Harmeyer, 2013).

- The SaeboStretch is one option available for clients who are able to achieve at least neutral wrist extension with all finger joints in composite extension. Occupational therapists must be trained in order to prescribe and use Saebo orthoses with their clients. For eligibility criteria and information on SaeboStretch orthoses, please see www.saebo.com.

- Ensure education is provided regarding wearing schedules and precautions when a client is provided with a splint. Occupational therapists should monitor the effectiveness of the splint in regards to the specific goals and adjust or discharge the splint as required. Additional information should be provided at the time of discharge, if the client still requires the use of a splint. For an example of a splint instructions handout, please see page 40.

Splint Instructions

PURPOSE OF YOUR SPLINT:

- The splint prescribed was made for you to:
  - Stretch your hand, wrist and/or fingers
  - Support your hand, wrist and/or fingers
  - Prevent contractures (i.e. permanent joint stiffness)
  - Reduce swelling
  - Reduce pain
  - Promote function
  - Stabilize your _____ joint
  - Other:_____

WEARING SCHEDULE:

- Your splint should be worn _____
  _____

CARE OF YOUR SPLINT:

- Do not expose your splint to heat sources including a radiator, a stove, the sun, an open flame, hot water or a closed car on a hot day.
- Wash your splint daily with lukewarm water and mild soap. If the straps are removable, they can be hand-washed and laid flat to dry. Splint liners can also be hand-washed and laid flat to dry.

POSSIBLE SPLINT CONCERNS:

- If you notice any of the following issues below, please contact your occupational therapist and discontinue wearing your splint until you are reassessed.
  - Redness or irritation of your skin
  - Pain or numbness in your wrist, hand, or fingers
  - Your fingers or hand are turning blue (circulation is decreased)
  - The splint no longer fits correctly
  - The splint is broken
  - Changes in your finger joints are starting to occur, such as:


Note: If you are no longer followed by an occupational therapist, you will need to obtain a new Occupational Therapy referral from your primary healthcare provider.

Occupational Therapist: _____ Phone: _____

(Adapted from: Health Sciences Centre Occupational Therapy Department, 2013)

8.1.6d Shoulder Girdle Taping

The Evidence-Based Review of Stroke Rehabilitation states: “Strapping / taping the hemiplegic shoulder does not appear to improve upper limb function, but may reduce pain” (Cotoi et al., 2016, p. 19).

The Evidence-Based Review of Stroke Rehabilitation states: “Strapping the hemiplegic shoulder is used as a method to prevent or reduce the severity of shoulder subluxation and may provide some sensory stimulation” (Cotoi et al., 2016, p. 18).

There are various taping techniques that are used on the shoulder girdle that seek to optimize alignment and reduce pain (e.g. McConnell approach, Tri-pull).

8.1.7 Spasticity Management

The Canadian Stroke Best Practice Recommendations 5.2.ii states: "Chemodenervation using botulinum toxin can be used to increase range of motion and decrease pain for patients with focal and/or symptomatically distressing spasticity [Evidence Levels: Early-Level C; Late-Level A]" (Hebert, 2016, p. 12).

The Evidence-Based Review of Stroke Rehabilitation states: "Botulinum toxin works by weakening spastic muscles through blocking the release of acetylcholine at the neuromuscular junction. The benefits of botulinum toxin injections are generally dose-dependent and last approximately 2 to 4 months (Bakheit et al. 2001; Brashear et al. 2002; Francisco et al. 2002; Simpson et al. 1996; Smith et al. 2000)" (Foley et al., 2016, p. 68).

The Evidence-Based Review of Stroke Rehabilitation states: "There is Level I evidence that treatment with botulinum toxin alone or in combination with therapy significantly reduces spasticity in the upper extremity and overall disability in stroke survivors" (Foley et al., 2016, p. 72).

The United Kingdom's National Guidelines for *Spasticity in Adults: Management using Botulinum Toxin* states: "It is important to:

- Assess the need for orthotics / splinting or review existing orthoses as appropriate once the clinical effect of muscle weakening is observed (usually 7–14 days post-injection) and ensure there is a system to review the orthotics / splinting provision, provide new orthoses as required and assess patient compliance.
- Provide patient education on stretching regimes and guidance on participating in activities . . ." (Royal College of Physicians, British Society of Rehabilitation Medicine, Chartered Society of Physiotherapy, Association of Chartered Physiotherapists Interested in Neurology, 2009, p. 21).

A review of arm function, including range of motion and tone, prior to injection will assist with treatment planning and monitoring of outcomes.

It is best to combine botulinum toxin with therapy:

- Occupational therapists should communicate with the physiatrist regarding functional goals, outcome of previous injections and treatment plan.
- Post injection, therapy and home programs can focus on strengthening the antagonist muscles as new movement may now be possible. Active movement training can often be progressed.
- "Splinting provides a prolonged stretch to a muscle and, when used together with BT [botulinum toxin], aims to improve muscle length, correct and prevent contractures and maximise function" (Royal College of Physicians, British Society of Rehabilitation Medicine, Chartered Society of Physiotherapy, Association of Chartered Physiotherapists Interested in Neurology, 2009, p. 21).
- Splints to help improve range of motion of the elbow, forearm, wrist, and hand as well as functional splints can be considered. Refer to pages 38 and 39 for splinting considerations.
- Splints should be reassessed frequently, including wrist and finger angles, resistance of springs on dynamic splints, wearing schedule, skin integrity, and tolerance as well as changes in functional ability.
- Functional electrical stimulation may be used post injection to antagonist muscle groups.

8.1.8 Supplementary Training Programs

The Canadian Stroke Best Practice Recommendations 5.1.B.viii states: “Therapists should consider supplementary training programs aimed at increasing the active movement and functional use of the affected arm between therapy sessions, e.g. Graded Repetitive Arm Supplementary Program (GRASP) suitable for use during hospitalization and at home [Evidence Level: Early-Level B, Late-Level C]” (Hebert et al., 2016, p. 12).

The GRASP program requires palpable or grade 1 wrist extension and active scapular elevation. A client who is unable to partially open the hand is not appropriate for the GRASP program (Eng, Harris, Dawson, & Miller, 2012). Please see the following resource for more details: http://neurorehab.med.ubc.ca/grasp/.

Supplementary training programs should be provided so that strengthening, range of motion and functional activities completed in therapy can be practiced between therapy sessions with the goal of increasing the intensity and the number of repetitions being done. Since higher repetitions of upper extremity use have been associated with better upper extremity outcomes post stroke (Birkenmeier, Prager, & Lang, 2010), frequent use of the upper extremity between therapy sessions is critical.

Consider the use of a daily homework log or journal as a way of recording activities done at home, and to increase compliance and accountability.

8.1.9 Mirror Therapy

The Canadian Stroke Best Practice Recommendations 5.1.B.v states: "Mirror therapy should be considered as an adjunct to motor therapy for select patients. It may help to improve upper extremity motor function and ADL's (Evidence Level: Early-Level A; Late-Level A)" (Hebert et al., 2016, p. 12).

The Evidence-Based Review of Stroke Rehabilitation states: "Mirror therapy is a technique that uses visual feedback about motor performance to improve rehabilitation outcomes. Ramachandran et al. (1995) first used this method to understand the effect of vision on phantom sensation in arm amputees. This method has since been adapted from its original use (as a method to "re-train the brain") as a means to enhance upper-limb function following stroke and to reduce pain (Sathian et al. 2000). In mirror therapy, patients place a mirror beside the unaffected limb, blocking their view of the affected limb and creating an illusion of two limbs which are functioning normally. It is believed that by viewing the reflection of the unaffected arm in the mirror, this may act as substitute for the decreased or absent peripheral and proprioceptive input to the affected arm" (Foley et al., 2016, p. 40).

Mirror therapy involves the client placing their affected hand and forearm inside the mirror box and their unaffected hand and forearm in front of the mirror. The client is then directed to perform a movement with their unaffected hand and to simultaneously attempt to copy the movement with their hidden affected hand. The client should be looking at the image in the mirror while attempting to move the affected hand.

A "mirror box" can be purchased (e.g. http://www.mirrorboxtherapy.com). Alternatively, mirror boxes can be made by bending cardboard into an inverted V (large enough for the affected hand to fit under) or by using a box with a mirror attached on one side. Homemade versions have been effectively used with many clients.

Mirror therapy can be provided as homework. Occupational therapists should provide specific written instructions for the client, including the number of repetitions or duration of the activity. For an example of a mirror therapy script, see page 45.

Therapists can also refer to the mirror therapy pocket booklet on Stroke Engine at: http://www.strokengine.ca/wp-content/uploads/2016/01/Pocket_Card_mirror_therapy.pdf.

Mirror Therapy Sample Script:

Watch the mirror as you complete the activities. Make sure you are trying to do these activities with your affected (right / left) hand at the same time. Do these exercises 2 – 3 times a day. Go slowly!

1. Make a fist and then open your hand fully. Repeat 15 times.
2. Pretend to play the piano, pushing each finger on the table one at a time. Continue for 2 minutes.
3. Touch your thumb to the tip of each finger. Repeat 15 times for each finger.
4. Place a washcloth on the table. Wipe the table in a circular motion, back and forth, and up and down, for 2 minutes.
5. Place a water bottle on the table. Grasp it with your hand, lift it up 2 inches, place it back on the table and then let go. Repeat 15 times.
6. Place 5 coins on the table. Pick them up one at a time until they are all in your palm. Place them back on the table, one at a time, using your thumb with your index and middle fingertips. Repeat entire process 3 times.

8.1.10 Sensory Stimulation and Re-training

The Canadian Stroke Best Practice Recommendations 5.1.B.vi states: “It is uncertain whether sensory stimulation (e.g., transcutaneous electrical nerve stimulation (TENS), acupuncture, muscle stimulation, biofeedback) improves upper extremity motor function [Evidence Level B]” (Hebert et al., 2016. p. 12).

The Evidence-Based Review of Stroke Rehabilitation states: “Sensorimotor impairment is associated with slower recovery following stroke; therefore, therapies to increase sensory stimulation may help to improve motor performance” (Foley et al., 2016, p.23).

An occupational therapist involved in sensory retraining should:

- Educate client / caregiver regarding the purpose of sensation, safety concerns, and upper extremity protection.
- Modify the environment for safety (e.g. adjust water temperature).
- Introduce varied textures and sensations (e.g. wash cloth, rice, macaroni).
- Use different weights, sizes, and shapes of objects to promote discrimination.
- Use vision as a compensatory strategy, progressing to occluding vision if able and if safety permits.

For sensation re-training practical examples, see page 47.

For safety tips that can be used with clients with decreased sensation, see page 48.

Sensation Re-training Practical Examples

1. Take a washcloth and rub it over your affected hand in a circular motion (include forearm too as necessary). Repeat this for 10 minutes. Keep watching the cloth and try to "feel" it on your skin.

2. Lightly tap your affected hand with your less affected hand from your forearm to your fingertips. Repeat for 10 minutes.

3. Use your affected fingertips to trace a textured maze (e.g. Velcro, string, cotton balls, felt, etc.) with your eyes opened or closed.

4. Clap your hands together at shoulder level. Make sure you hear a loud "clap". Repeat 10 times.

5. Place a butter knife on the table in front of you. Pick it up using only your affected hand. Get the butter knife in a good position to cut, and then tap the table with the tip of it as if you are cutting (or have an item to actually cut, e.g. theraputty). Put the knife down on the table. Repeat 10 times making sure that you have the correct grip each time you pick up the knife.

6. Place a pen or straw in your affected hand, holding it at the bottom. Work your way to the top of the pen using only your fingertips. Repeat up and down 10 times.

7. Put 5 coins in your pocket. Use your affected hand to pull them out in order from smallest to largest. Repeat 2 times.

8. Get a dark colored cloth bag. Place various items inside of it (screw, button, paperclip, spoon, safety pin, coins, etc.), with a list of each item written out. Choose an item from the list and try to find it in the bag one at a time. Keep track of how many you can find correctly each day.

9. Place a variety of items in a bowl of rice, macaroni, beans, or cereal, and remove them one at a time with your eyes opened or closed.

Safety Tips For Decreased Sensation

After a stroke you may have decreased sensation (feeling) in certain areas of your body, especially your hands and feet. Decreased sensation means that you may have more difficulty feeling pain, pressure, and temperature, making you more at risk of injuring yourself. The following are tips on how to prevent common injuries and increase safety:

- Use your less affected hand to check water temperature (e.g. before having a shower or washing the dishes).
- Label water faucet handles for hot and cold (e.g. red for hot and blue for cold).
- Use your less affected hand to handle sharp, hot or cold objects.
- Look at the position of your affected arm:
  - When your affected arm is actively performing a task (e.g. look before reaching into a cutlery drawer to ensure you do not cut your hand on a knife).
  - When your affected arm is at rest (e.g. look to ensure your hand is not near the stove element).
- Protect your affected arm during hot and cold seasons:
  - Wear mittens in cold weather to prevent frost bite.
  - Apply sunscreen in warmer weather to prevent sun burn.
- Ensure you are not holding items too tightly which can damage your skin.
- Check your skin daily to ensure there are no pressure (red / darker) areas. Report any changes to your healthcare provider.

8.1.11 Range of Motion and Strength Training

The Canadian Stroke Best Practice Recommendations 5.1.B.i states: "Range of movement exercises (passive and active assisted) should be provided that includes placement of the upper limb in a variety of appropriate and safe positions within the patient's visual field [Evidence Level C]" (Hebert et al., 2016, p. 11).

The Canadian Stroke Best Practice Recommendations 5.3.A states that to help prevent hemiplegic shoulder pain and subluxation, "Overhead pulleys should not be used [Evidence Level A]" and "The arm should not be moved beyond 90 degrees of shoulder flexion or abduction, unless the scapula is upwardly rotated and the humerus is laterally rotated [Evidence Level A]" (Hebert et al., 2016, p. 13).

The Canadian Stroke Best Practice Recommendations 5.3.C.i. states: "Treatment of hemiplegic shoulder pain related to limitations in range of motion includes gentle stretching and mobilization techniques, and typically involves increasing external rotation and abduction [Evidence Level B]. Active range of motion should be increased gradually in conjunction with restoring alignment and strengthening weak muscles in the shoulder girdle [Evidence Level B]" (Hebert et al., 2016, p. 13).

The Canadian Stroke Best Practice Recommendations 5.1.B.ix states: "Strength training should be considered for persons with mild to moderate upper extremity function in both subacute and chronic phases of recovery. Strength training does not aggravate tone or pain (Evidence Level A)" (Hebert et al., 2016, p. 12). Section 5.2.iv states: "The presence of spasticity should not limit the use of strength training in the arm [Evidence Level: Early-Level C; Late-Level C]" (Hebert et al., 2016, p. 13).

The Canadian Stroke Best Practice Recommendations 5.1.B.x states: "Bilateral arm training does not appear to be superior to unilateral arm training in improving upper extremity motor function [Evidence Level B]" (Hebert et al., 2016, p. 12).

The Canadian Stroke Best Practice Recommendations 5.3.E.i states: "Active, active assisted, or passive range of motion exercises should be used to prevent Chronic Regional Pain Syndrome (CRPS) [Evidence Level C]" (Hebert et al., 2016, p. 13).

Active range of motion should be encouraged as early as possible. Occupational therapists should consider the use of gravity reduced positions to facilitate active movement (e.g. supine, side-lying).

Active assisted range of motion describes the client initiating maximal active movement with their affected upper extremity; the movement is then completed by either the client using their less affected upper extremity to assist their affected upper extremity or by the occupational therapist providing assistance.

Passive range of motion should be provided by occupational therapists or trained caregivers to help maintain full joint range of motion and to prevent contractures.

Self-range of motion is often provided to clients as homework to maintain or improve joint range of motion. Self-range may not be appropriate if the client does not have the cognitive abilities to carry out recommendations independently and safely.

For an example of a self-range of motion program, please see page 50.

Self-Range of Motion Exercises for the Arm

What is self-range?

Self-range of motion exercises can be used after a stroke when one arm or hand is unable to perform exercises on its own. During self-range, the less affected arm is used to help the affected arm or hand through the desired movement.

Why is it important?

It is important to move the affected arm to keep the muscles mobile and the joints flexible. Other benefits may include:

- Prevention of stiffness
- Improved movement within the joint
- Improved sensory and body awareness
- Reduced swelling

Most importantly, self-range of motion exercises can help make daily activities (e.g. dressing, grooming) easier.

General Guidelines

- Participate in these exercises at least _____ time(s) a day.
- Keep movements slow and controlled; avoid rapid and jerky movements.
- Hold each position for at least 5 seconds, or as indicated by your therapist.
- Do not "overdo it"; do not force the movement.
- Exercises will cause a stretch but should not cause sharp pain.
- If exercises cause sharp pain, stop until you are able to speak to your therapist.

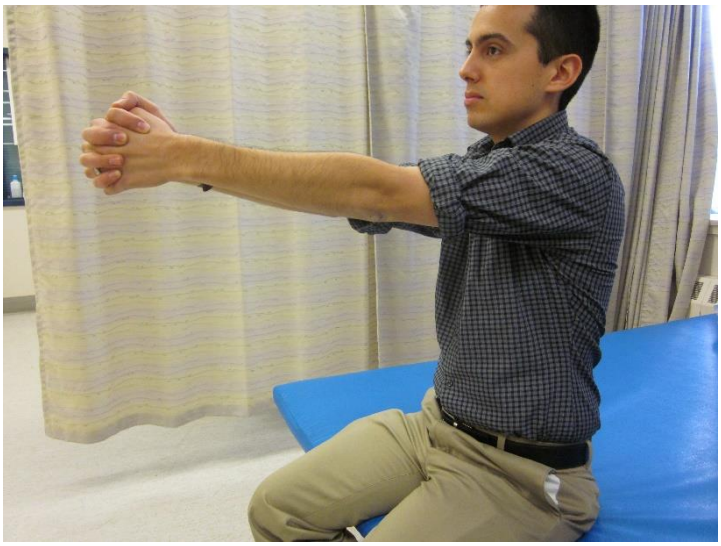
If you have any questions, contact your therapist_____ at_____.

Shoulder Flexion

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support your affected (right/left) arm.
2. Raise your arms forward and up to shoulder height.
3. Try to keep both elbows straight.
4. Lower your arms slowly.

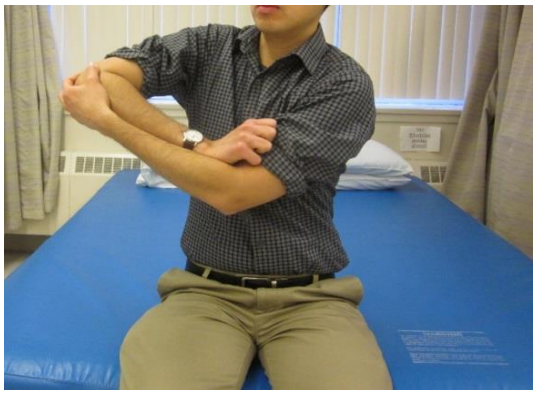


Shoulder Abduction / Adduction

Starting position: ☐ Lying on back ☐ Sitting

Repeat _____ times.

1. Support the elbow, forearm and wrist of your affected arm (right/left) with your less affected arm (right/left), as if holding a baby.
2. Move your arms to the right, away from your body. The goal is to get your elbow to reach shoulder height.
3. Move your arms to the left, away from your body. The goal is to get your elbow to reach shoulder height.
4. Attempt to move your arms only, without moving the rest of your upper body.



Shoulder Internal / External Rotation

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support the affected (right/left) arm.
2. Keep your elbows bent and close to the sides of your body.
3. Use your less affected (right/left) arm to move your affected (right/left) arm across your body. Keep the elbow of your affected (right/left) arm bent and close to your side.
4. Use your less affected (right/left) arm to move your affected (right/left) arm away from your body. Keep the elbow of your affected (right/left) arm bent and close to your side.

Elbow Flexion / Extension

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

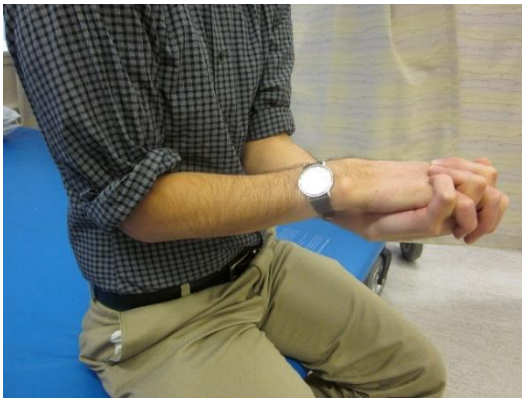
1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support your affected (right/left) arm.
2. Bend your elbows to bring your hands toward your chest. Try to touch your chin.
3. Straighten your elbows. Attempt to straighten both elbows fully.


Forearm Supination / Pronation

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support the affected (right/left) arm.
2. Keep your affected (right/left) elbow bent and close to the side of your body, with your hands pointing forward.
3. Use your less affected (right/left) arm to rotate your affected (right/left) arm so the palm faces upward.
4. Use your less affected (right/left) arm to rotate your affected (right/left) arm so the palm faces downward.



Wrist Flexion / Extension

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support the affected (right/left) arm.
2. Keep your elbows bent and close to the side of your body, with your hands pointing forward.
3. Use your less affected (right/left) hand to bend your affected (right/left) wrist to the left.
4. Use your less affected (right/left) hand to bend your affected (right/left) wrist to the right.

Wrist Radial / Ulnar Deviation

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by:
   - ☐ Interlocking your fingers with your affected (right/left) thumb on top.
   - ☐ Holding your wrist to support the affected (right/left) arm.
2. Keep your elbows bent and close to the side of your body, with your hands pointing forward.
3. Use your less affected (right/left) hand to bend the affected (right/left) wrist so your hand moves toward your chest.
4. Use your less affected (right/left) hand to bend your affected (right/left) wrist so your hand moves away from your chest.

Finger Flexion / Extension

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by placing your affected (right/left) arm on your lap or a table.
2. Use your less affected (right/left) hand to bend all the fingers of your affected (right/left) hand until your fingertips touch your palm.
3. Use your less affected (right/left) hand to open all the fingers of your affected (right/left) hand so they are straight.


Thumb Flexion / Extension

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

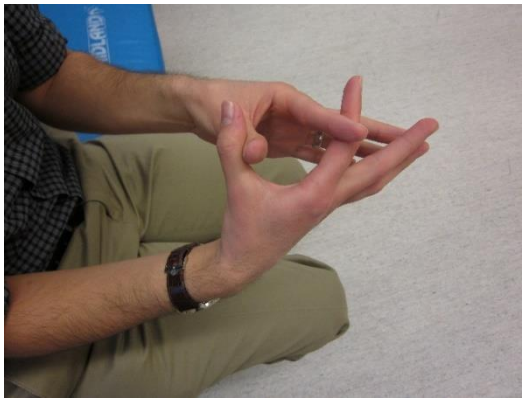
1. Begin by placing your affected (right/left) arm on your lap or a table.
2. Use your less affected (right/left) hand to move your affected (right/left) thumb to touch the base of your little finger.
3. Use your less affected (right/left) hand to move your affected (right/left) thumb away from your hand.


Thumb Abduction

Starting position: ☐ Lying on back ☐ Lying on less affected (right / left) side ☐ Sitting

Repeat _____ times.

1. Begin by placing your affected (right/left) arm on your lap or a table.
2. Use your less affected (right/left) hand to move your affected (right/left) thumb away from your palm (stretch thumb and index finger apart).



8.1.12 Edema Management

The Canadian Stroke Best Practice Recommendations 5.3.D.i states: "For patients with hand edema, the following interventions may be considered: a) Active, active-assisted, or passive range of motion exercises in conjunction with arm elevation [Evidence Level C]. b) Retrograde massage [Evidence Level C] . . ." (Hebert et al., 2016, p. 13).

"Active and active-assisted extremity movement patterns produce muscular contractions that assist venous and lymphatic return of the fluid" (Ryerson & Levit, 1997, p. 771).

In general, elevating the upper extremity with the hand above the heart can be beneficial in edema management. When sitting or lying down, pillows can be used to assist with positioning the hand (Kasch & Walsh, 2013).

"Despite a lack of evidence for the efficacy of light retrograde massage in stroke patients . . . it is often used in clinical practice and . . . consensus exists about many components of the treatment method" (Jackson, van Teijlingen & Bruce, 2012, p. 549).

"Compression bandaging may have benefits in the management of edema after stroke" (Gustafsson, Walter, Bower, Slaughter, & Hoyle, 2014, p. 203). Compression gloves, sleeves, and wrapping for finger edema (e.g. Coban) can be used and monitored frequently.

Splints may be considered and trialled to manage hand edema in the low level arm post stroke, however they need to be frequently evaluated. They should not be long term interventions or used during the day if they interfere with active movement. Refer to splinting considerations on pages 38 and 39 as needed. Provide client handout regarding splint instructions on page 40 as needed.

A combination of interventions is typically used for edema management.

8.1.13 Virtual Reality

The Canadian Stroke Best Practice Recommendations 5.1.B.vii states: “Virtual reality, including both immersive technologies such as head mounted or robotic interfaces and non-immersive technologies such as gaming devices can be used as adjunct tools to other rehabilitation therapies as a means to provide additional opportunities for engagement, feedback, repetition, intensity and task-oriented training (Evidence Level: Early-Level A; Late-Level A) (Hebert et al., 2016, p. 12).

Examples of non-immersive systems are the Nintendo Wii and the SaeboReJoyce.

Further research continues to emerge in this developing area of upper extremity rehabilitation.

9.0 Reassessment Guidelines:

It is important to frequently reassess a client's upper extremity function to monitor progress and modify treatment plans. Reassessment helps to determine if a client's goals have been met or need to be revised. Reassessment can include re-administering initial assessment tools and reviewing SMART goals with the client, as well as evaluating use of the upper extremity in activities of daily living. Treatment plans may be modified based on reassessment results.

10.0 References:

Birkenmeier, R. L., Prager, E. M., & Lang, C. E. (2010). Translating animal doses of task-specific training to people with chronic stroke in 1-hour therapy sessions: A proof-of-concept study. *Neurorehabilitation and Neural Repair, 24*(7), 620-635. doi: 10.1177/1545968310361957

Bondoc, S., & Harmeyer, F. (2013). Splinting the neurological hand. *OT Practice, 18*(8), 9-14.

Chest Heart & Stroke Scotland. (2012). *Positioning for people affected by stroke*. Retrieved from http://www.chss.org.uk/documents/2013/08/f16_stroke_positioning_chart.pdf

College of Occupational Therapists and Association of Chartered Physiotherapists in Neurology. (2015). *Splinting for the prevention and correction of contractures in adults with neurological dysfunction: Practice guideline for occupational therapists and physiotherapists*. London, UK: College of Occupational Therapists Ltd.

Cotoi, A., Viana, R., Wilson, R., Chae, J., Miller, T., Foley, N., & Teasell, R. (2016). *Evidence-based review of stroke rehabilitation: Painful hemiplegic shoulder*. Retrieved from http://www.ebrsr.com/evidence-review/11-painful-hemiplegic-shoulder

Eng, J., Harris, J., Dawson, A., & Miller, B. (2012). *Graded repetitive arm supplementary program: A home-work based program to improve arm and hand function in people living with stroke. Guidelines & Manual*. Vancouver, BC. Retrieved from http://med-fom-neurorehab.sites.olt.ubc.ca/files/2012/10/GRASP-Instruction-Manual_2012.pdf

Foley, N., Cotoi, A., Serrato, J., Mirkowski, M., Harris, J., Dukelow, S., Sequeira, K., Knutson, J., Chae, J., & Teasell, R. (2016). *Evidence-based review of stroke rehabilitation: Upper extremity interventions*. Retrieved from http://www.ebrsr.com/evidence-review/10-upper-extremity-interventions

Gowland, C., VanHullenaar, S., Torresin, W., Moreland, J., Vanspall, B., Barrecca, S., Ward, M., Huijbregts, M., Stratford, P., & Barclay-Goddard, R. (1995). *Chedoke-McMaster stroke assessment*. Hamilton, ON: Chedoke-McMaster Hospitals and McMaster University.

Gustafsson, L., Walter, A., Bower, K., Slaughter, A., & Hoyle, M. (2014). Single-case design evaluation of compression therapy for edema of the stroke-affected hand. *American Journal of Occupational Therapy*, *68*, 203-211.

Harley, M. Y. (2013, April 29). *The return of a second hand: Studies in neuroplasticity after stroke* [Webinar]. Retrieved from http://www.occupationaltherapy.com/ot-ceus/search/term:the%20return%20of%20a%20second%20hand/

Health Sciences Centre Occupational Therapy Department. (2013). *Splinting discharge instructions* [Client handout], Winnipeg, MB, Canada.

Hebert, D., Lindsay, M. P., McIntyre, A., Kirton, A., Rumney, P. G., Bagg, S. et al. (2016). Canadian stroke best practice recommendations: Stroke rehabilitation practice guidelines, update 2015. *International Journal of Stroke*, 11(4), 459-484. Retrieved from http://journals.sagepub.com/doi/full/10.1177/1747493016643553

Jackson, T., van Teijlingen, E. R., & Bruce, J. (2012). Light retrograde massage for the treatment of post-stroke upper limb oedema : Clinical consensus using the delphi technique. *British Journal of Occupational Therapy, 75*(12), 549-554. doi: 10.4276/030802212X13548955545495

Kasch, M. C., & Walsh, J. M. (2013). Hand and upper extremity injuries. In H. M. Pendleton, & W. Schultz-Krohn (Eds.), *Pedretti's occupational therapy: Practice skills for physical dysfunction* (7th ed., pp. 1037-1073). St. Louis, MS: Mosby, Inc.

Kleim, J. A., & Jones, T. A. (2008). Principles of experience-dependent neural plasticity: Implications for rehabilitation after brain damage. *Journal of Speech, Language, and Hearing Research, 51*(1), S225-S239. doi: 10.1044/1092-4388(2008/018)

Krueger, H., Koot, J., Hall, R., O'Callaghan, C., Bayley, M., & Corbett, D. (2015). Prevalence of individuals experiencing the effects of stroke in Canada. *Stroke*, 46, 2226-2231.

Lang, C., & Birkenmeier, R. (2014). *Upper-extremity task-specific training after stroke or disability: A manual for occupational therapy and physical therapy*. Bethesda, MD: American Occupational Therapy Association Press.

Law, M., Baptiste, S., Carswell, A., McColl, M. A., Polatajko, H., & Pollock, N. (2014). *Canadian Occupational Performance Measure* (5th ed.). Ottawa, ON: CAOT Publications ACE.

McInnes, K., Friesen, C., & Boe, S. (2016). Specific brain lesions impair explicit motor imagery ability: a systematic review of the evidence. *Archives of Physical Medicine and Rehabilitation*, 97, 478-489.

Ohio State University Wexner Medical Centre. (2002). *Self-range of motion exercises for shoulders, arms, wrists, fingers*. Retrieved from http://www.sld.cu/galerias/pdf/sitios/rehabilitacion/self-range_of_motion.pdf

Page, S. J. (2001). Mental practice: A promising restorative technique in stroke rehabilitation. *Topics in Stroke Rehabilitation, 8*(3), 54-63. doi: 10.1310/7WDU-V2EA-76F8

Royal College of Physicians, British Society of Rehabilitation Medicine, Chartered Society of Physiotherapy, Association of Chartered Physiotherapists Interested in Neurology. (2009). *Spasticity in adults: Management using botulinum toxin. National guidelines.* London, UK: Royal College of Physicians. Retrieved from https://www.rcplondon.ac.uk/sites/default/files/documents/spasticity-in-adults-management-botulinum-toxin.pdf

Ryerson, S. and Levit, K. (1997). *Functional movement reeducation: A contemporary model for stroke rehabilitation*. New York, NY: Churchill, Livingstone.

Saebo Inc. (2013). *Improving upper extremity motor recovery following neurological injury* [Certification course manual]. Charlotte, NC: Saebo, Inc.

Sirtori, V., Corbetta, D., Moja, L., & Gatti, R. (2009). Constraint-induced movement therapy for upper extremities in stroke patients. *Cochrane Database of Systemic Reviews, 4*. doi: 10.1002/14651858.CD004433.pub2

Stevenson, T., & Thalman, L. (2007). *Rehabilitation of the hemiparetic upper extremity* [Lecture notes], School of Medical Rehabilitation, University of Manitoba, Winnipeg, MB, Canada.

Teasell, R. & Hussein, N. (2016). *Stroke Rehabilitation Clinician Handbook: Motor Rehabilitation (Upper Extremity).* Retrieved from http://www.ebrsr.com/sites/default/files/Chapter%204B_Upper%20Extremity%20Post%20Stroke_0.pdf

Thalman, L. (2002). *Arm activity lis*t [Client handout], St. Boniface General Hospital Occupational Therapy Department, Winnipeg, MB, Canada.

Thalman, L. (2008). *Treating the arm: A smorgasborg* [Presentation], Saskatchewan Society of Occupational Therapists Annual General Meeting, Regina, SK, Canada.