

VERSION 1

# INSTRUCTION MANUAL

FOR THE  
ADMINISTRATION  
OF THE

**GRASP AND  
RELEASE TEST  
FOR TETRAPLEGIC  
HAND  
ASSESSMENT  
(GRT-THA)**



neural outcomes consulting Inc.

## GRT

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Group 1994  
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## GRT-THA V1

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## INTRODUCTION

The Grasp and Release Test (GRT) is a non-instrumented, one-handed object manipulation test used to measure hand function in people with tetraplegia. The GRT was originally designed to measure the effectiveness of an implanted neuroprosthesis (Peckham et al. 2001; Wuolle et al. 1994). The psychometric properties of the GRT were established by the developers for use with implanted FES (Wuolle et al. 1994) and later by Mulcahey et al including also arm/hand reconstructive surgery (Mulcahey, Smith, and Betz 2004).

The GRT is frequently used to measure changes in hand function as a result of upper extremity interventions in tetraplegia, such as tendon- and/or nerve transfers. To standardize its use in the tetraplegic population without the neuroprosthesis, some revisions of the test were needed. Therefore, the GRT for Tetraplegic Hand Assessment (GRT-THA) was developed. Six centers specialized in interventions for tetraplegic upper limb were involved in the development of the revised manual.

The GRT is administered as one main test including six objects. The participants are to grasp and release each object as many times as possible in a 30-second trial. The number of completions in the 30-second trial are counted. Comparisons of the number of objects successfully acquired before and after an intervention can identify changes in hand function as a result of the procedure.

Six objects are tested in the GRT; peg, paperweight, fork, block, juice can and videotape/book (Fig 1 and 2). The objects vary in size, weight and surface texture. The objects represent a range of difficulty that can measure differences in performance.

The test has been designed to minimize effects of extraneous factors which may interfere with the performance of the hand, such as fatigue of the proximal musculature or instability of the trunk. Therefore, the test board is placed in front of the participant and biased toward the test hand as needed to minimize reaching effort. The test stipulates consistent equipment placement, and test board location so that performance over time and across participants may be compared meaningfully.

## OBJECTIVES

The Objectives of the GRT-THA are:

- A. To determine the ability to acquire, grasp, and release a series of objects ranging in size and weight.
- B. To determine ability to acquire, grasp, and release objects changes as a result of an intervention or changes over time.

## MATERIALS

### A. Evaluator Kit (provided):

1. Test board and box (Fig. 1)
2. Test objects (Figs. 1 and 2)
  - a. Pegs (40) wooden peg 1.46 gr, 7.55 x 0.607 cm
  - b. Paperweights (3) steel disk 264 gr, 5.0 cm in dia.
  - c. Fork and base (1) cylindrical handle requires 0.44 kg to depress
  - d. Blocks (40) wooden block 10.6gr, 2.54 x 2.54 x 2.54 cm
  - e. Juice cans (3) plastic cylinder 210 gr, 8.64 H x 5.09cm dia.
  - f. Videotapes (3) plastic case 334 g, 20.3 x 12.1 x 2.90 cm
3. Timer
4. Manual
5. Test forms (Appendix A in manual)

### B. Accessible Table



## DESCRIPTION OF THE GRT-THA

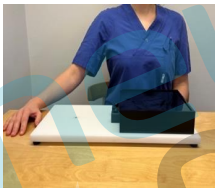
### General description

The participants are asked to acquire, move and release as many objects as possible in a 30-second trial. Before each task practice is recommended. At the start of each trial, the therapist prompts the participant by saying “ready”, waits three seconds, says “go”, and starts the timer count down. During the trial, the therapist replaces each object as the participant continues.

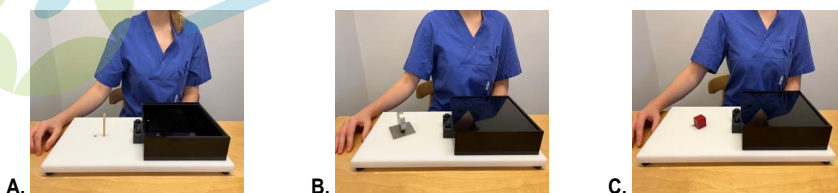
The tasks are performed in order of the scoring sheet. They are allowed a short rest between each trial (30-60 sec).

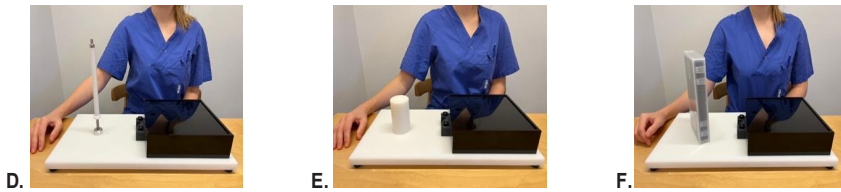
### Starting position

The starting position of all tasks are seated in front of a table with the board in parallel to the table with the release area (the box) towards the participant’s midline (sternum). The tested arm must rest beside the table before initiating each trail. The details of the participant’s hand, and the acquisition and release points are indicated in Fig. 2. Figure 3 shows the correct placement and orientation of each object as seen from the therapist’s side of the test board.



**Figure 2.** View of the test set-up, showing proper orientation of test board relative to the participant. The long edge of the test board is placed parallel to the edge of the table, with the release area (the box) towards the participant’s midline (sternum). The proper starting location for the tested hand is resting on the table next to the board.





**Figure 3.** Correct initial placement and orientation of objects as seen from the therapist's side of the test board for a participant's left hand being tested. Figure 3a. Peg; Figure 3b. Paperweight; Figure 3c. Block; Figure 3d. Fork; 3e. Can; Figure 3f. Video/Book.



## TESTING INSTRUCTIONS

The following is a brief description of the method of acquisition and movement of each object. The object must be manipulated using the general guidelines listed below. It is important to instruct the participant to perform the tasks as quickly as they can, while trying not to make any errors. If an error is made, the therapist replaces the object in the starting position and continues testing.

The specific test instructions that must be read to the participant are presented in the "Instruction to participants", in the right column below.

### Criteria in judging a successful completion of the task:


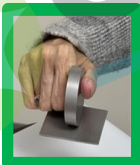

- 1) The participant must use the *active and passive* force that can be generated with the hand and must **not rely on rotating the forearm** to eliminate gravity
- 2) The participant may **not wear gloves/splints** on the thumb or fingers (wrist cock-up splints are acceptable).
- 3) The participant is **not allowed to wet/lick their fingers** before testing
- 4) The object must not be missed, must not slip and must not be dropped when the participant is trying to grasp it.
- 5) The participant must **not use the sides of the test box or barrier** to assist in acquisition, movement, or release of the object.
- 6) The object must be released at the proper location and with the correct orientation (objects that bounce out of the box are considered failures).
- 7) The participant must use **only one hand** for acquisition, movement and release.



**Before starting the test, sanitize the hands of both the participant and yourself, in order to keep the test clean and to remove any skin oil on the hands.**


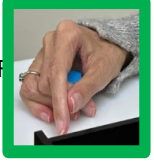











**INSTRUCTIONS TO THERAPIST AND PARTICIPANT**

<b>Introduction to Participant:</b>	
<p>"Please sanitize your hands before touching the items (<i>therapist sanitize as well</i>).</p> <p>I would like you to perform a series of tasks that require you to grasp, move and release different objects. In each trial, try to grasp and release as many objects as you can within 30 seconds, without making any errors.</p> <p>"The evaluation consists of six tasks. I will show you how to do each task and have you attempt each task prior to the test. You may continue your attempt until you feel comfortable with that task. If you cannot do the task, please tell me whether or not you feel you have given the task your best effort.</p> <p>You must begin all tasks with your hand here (<i>demonstrate position, tested arm is placed at the side edge of the test board</i>). See fig 2.</p> <p>You are not allowed to use gloves or splints on your hand and you are not allowed to wet your fingers to get better purchase.</p> <p>If you or the item touch the side of the box, rotate your arm to help hold the object, miss or drop the object, push the object off the board, or release the object incorrectly, it will be considered an error. (<i>Demonstrate each type of error as you read.</i>) I will then replace the object at its starting point, and you are to continue from that point. Remember it is important to go quickly but try not to make errors.</p> <p>Do you have any questions?"</p>	
<b>PEG</b>	
<b>Instructions to THERAPIST</b>	<b>Instructions to PARTICIPANT</b>
<p>A peg is placed initially in the hole in the center of the acquisition area.</p> <p>Remove the lid from the box</p> <p>The participant must Pick up the peg with the thumb and another finger and drop it in the test box without the peg bouncing out of the box and without touching the peg to the side of the test box or to the barrier.</p> <p>The participant must not</p> <ul style="list-style-type: none"> <li>• Use the edge of the test box to help pull the peg from the hand during release.</li> <li>• Pick the peg up between his fingers.</li> </ul> <p>Tips to therapist to be faster: Put down the peg on the board and then slide the peg into the hole</p>	<p>"In the first task you will pick up this peg and drop it in the box (<i>demonstrate</i>). You must grasp the peg between your thumb and another finger (<i>demonstrate</i>), but not between fingers (<i>demonstrate</i>). You are not allowed to touch the side of the box to release the peg.</p> <p>If the peg falls over while you are attempting to grasp it, if you drop it outside of the box or it bounces out of the box, that is an error. I will replace the peg and you are to continue.</p> <p>As you move each peg during the test, I will place another at the starting position. Move as many pegs as you can in 30 seconds without making errors.</p> <p>Do you understand? Please try the task before we start the actual test.</p>

	
<p><b>PAPERWEIGHT</b></p>	
<p>The paperweight is placed initially in the center of the acquisition area at a 45-degree angle to the barrier (see Fig. 3b).</p> <p>Replace the lid of the box</p> <p>The participant must Pick up the paperweight by grasping the disk portion with the thumb and another finger, and then release it upright on the top of the test box, without touching it to the side of the test box.</p> <p>The participant must not</p> <ul style="list-style-type: none"> <li>• <b>rotate</b> his forearm to facilitate holding.</li> <li>• <b>Flex fingers under base of paperweight to facilitate holding</b></li> </ul>	<p>“In this next task you will pick up this paperweight by grasping the disk portion and then set the paperweight upright on the box (<i>demonstrate</i>). You must grasp the peg between your thumb and another finger (<i>demonstrate</i>), but not between fingers (<i>demonstrate</i>).</p> <p>You are not allowed to rotate your arm like this (<i>demonstrate with your arm rotating into supination to balance the paperweight</i>), push the paperweight against the box, or set it on the box like this (<i>demonstrate with the paperweight sitting crooked on the edge of the box</i>).</p> <p>As you move each paperweight during the test, I will place another at the starting position. Move as many paperweights as you can without making errors in 30 seconds.</p> <p>Do you understand? Please try the task before we start the actual test.”</p>
	

FORK	
<p>This object is different from the others in that it is not moved from one area to another. Screw the fork into a <i>90-degree angle</i> (upright).</p> <p>The participant must Grasp the handle of this fork mid-shaft with the thumb and index finger and push downward until the line appears, release the handle, and return his hand to the start position on the table before repeating the task.</p> <p>Note that the fork must be screwed into a <i>90-degree angle</i> (upright). There is however a 45-degree angle possibility on the board. This <i>should not</i> be included in the test. If the 90 degree angle cannot be performed it is considered as a failure of the sub task.</p> <p>The participant must not</p> <ul style="list-style-type: none"> <li>• Slide the hand down the handle and touches the cylinder at the base.</li> </ul>	<p>“In this task you will grasp the handle of this fork mid-shaft with your thumb and index finger and push it down without allowing your hand to slip and touch the base (<i>demonstrate</i>).</p> <p>When the line appears, release the hand, return your hand to <i>the side edge of the test board</i>, and repeat the task (<i>demonstrate</i>).</p> <p>Do you understand? Please try the task before we start the actual test.”</p>
	
BLOCK	
<p>The block is placed initially in the center of the acquisition area aiming at a 45-degree to the barrier (see Fig. 6). Only one block at the time should be placed on the board to standardize the position of the block.</p> <p>Remove the lid of the box</p> <p>The participant must Pick up the block and drop it into the box without touching it to the side of the test box or the barrier. The forearm must be in pronated position throughout the task. The participant is permitted to use a gross grasp - OR - pick up the block with his thumb and index finger.</p>	<p>In this task, you will pick up this block and drop it in the box. You can grasp the block with your thumb and fingers like this (<i>demonstrate</i>), or you can use a gross grasp like this (<i>demonstrate</i>).</p> <p>You are not allowed to rotate your arm like this (<i>demonstrate with your arm rotating into supination</i>). You must pick up the block and drop it into the box without touching it to the side of the test box.</p> <p>Remember each time you attempt to grasp the block and miss, or if you drop it outside of the box or the block bounces out of the box, it is considered an error. The block must land in the box.</p>

<p>The participant must not</p> <ul style="list-style-type: none"> <li>Use the edge of the test box to help pull the block from the hand during release.</li> </ul>	<p>Do you understand? Please try the task before we start the actual test."</p>
<div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;">OR</div>  </div>	<div style="display: flex; justify-content: space-around; align-items: center;">    </div>
<b>CAN</b>	
<p>Replace the lid of the box The cylinder, the same size and weight as a juice can, is placed initially in the center of the acquisition area.</p> <p>The participant must Grasp the can by its sides and its top must be exposed as if they would drink from it. The thumb could be slightly on the top if it cannot abduct around the can (example – after surgical reconstruction of lateral pinch). Move the can in an upright position to the top of the test box without rotating his forearm to facilitate holding, or touching the can to the side of the test box. The can must stand upright upon release. <i>At least three fingers</i> must be involved in the grip.</p> <p>The participant must not</p> <ul style="list-style-type: none"> <li>Rotate his forearm to facilitate holding.</li> <li>Grip the top of the can</li> <li>Use less than three fingers</li> <li>Use the side of the test box to assist in grasp or release</li> </ul>	<p>"In this task, you will grasp the sides of this can, as if intending to drink from the can, the top of the can must be free. Pick up the can and stand it on the box like this, (<i>demonstrate</i>), not like this (<i>demonstrate with the can sitting crooked on the edge of the box</i>).</p> <p>Remember, errors include dropping the can, touching the barrier or the test box, and rotating your arm like this, (<i>demonstrate with your arm rotating into supination to balance the can in your palm</i>).</p> <p>Do you understand? Please try the task before we start the actual test."</p>
	<div style="display: flex; justify-content: space-around; align-items: center;">    </div>

TAPE/BOOK	
<p>The tape/book is placed initially in the center of the acquisition area at a 45 degree to the barrier (see Fig.6).</p> <p>The participant must Pick up the tape by its large, flat sides (see shown in Fig.8). The required grasp includes the thumb and any of the other fingers (including key pinch). The participant must move the tape without rotating the forearm to facilitate holding, and release the tape upright on the top of the test box and release falling over.</p> <p>The tape may wobble after it is released by the participant. If it is not certain whether the tape will eventually fall over, the therapist must wait until the outcome is certain before proceeding. During a trial, while the participant is placing one tape on the release area, the therapist may place the next tape an inch or two from the center of the acquisition area to avoid interfering with the participant's hand movement.</p> <p>The participant must not</p> <ul style="list-style-type: none"> <li>• Supinate the forearm while moving the object.</li> <li>• Use the side of the test box to assist in grasping.</li> </ul>	<p>"In this task you will pick up this tape and stand it upright on the box like this (<i>demonstrate</i>), not like this (<i>demonstrates with tape sitting on the edge of the box</i>).</p> <p>The tape must stand after the release. If the tape falls over it counts as a failure.</p> <p>Remember that you are not allowed to rotate your arm to reduce weight or push against the box to grasp.</p> <p>Do you understand? Please try the task before we start the actual test."</p>
	

**SCORING**

The number of successfully moved items are counted during each 30-second trial and are recorded on the main test form.

## DATA ANALYSIS and REPORT

- The total score can be calculated as number of tasks successfully performed (maximum 6)  
AND/OR
- The sum score of successfully moved items in the six tasks.

## TIMER INSTRUCTIONS

In order to ensure that the therapist is able to set time and be ready to replace the item once moved, it is most convenient to allow the therapist 3 seconds to get into position as follows:

1. Set the "Clock/Timer" switch to "Timer".
2. Press the "SEC" button until the display reads "0:00.33" (i.e., 33 seconds)
3. At the start of a trial, say "Ready", and press the "START/STOP" button.
4. The timer will start counting down. When it reaches "30" say "Go".
5. When the timer reaches zero, the timer will beep and the participant should stop the trial.
6. Press the "START/STOP" button once to stop the time, a second time to reset the timer to 33 seconds.

*Do not press the "RESET" button. That will erase the program for 33 seconds.*



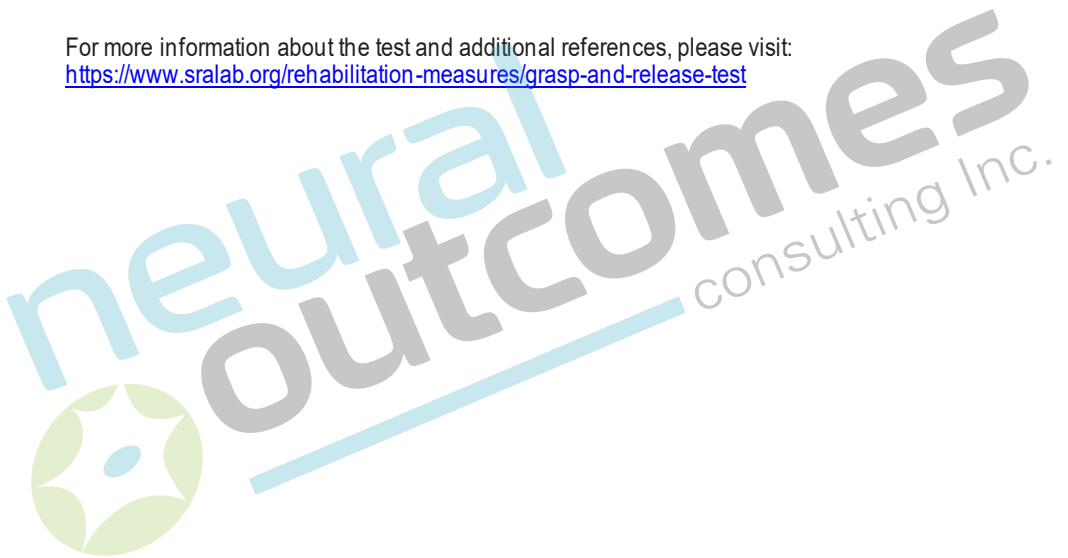
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Mulcahey M, Smith B, Betz R. Psychometric rigor of the Grasp and Release Test for measuring functional limitation of persons with tetraplegia: a preliminary analysis. *J Spinal Cord Med* 2004; 27:41-6.

For more information about the test and additional references, please visit:  
<https://www.sralab.org/rehabilitation-measures/grasp-and-release-test>



## **GRT TEAM AND DEVELOPERS**

### **GRT for hand neuroprosthetics in tetraplegia**

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## GRT- THA SCORE SHEET

### Criteria in judging a successful completion of the task:

- 8) The participant must use the *active and passive* force that can be generated with the hand and must **not rely on rotating the forearm** to eliminate gravity
- 9) The participant may **not wear gloves/splints** on the thumb or fingers (wrist cock-up splints are acceptable).
- 10) The participant is **not allowed to wet/lick their fingers** before testing
- 11) The object must not be missed, must not slip and must not be dropped when the participant is trying the grasp it.
- 12) The participant must **not use the sides of the test box or barrier** to assist in acquisition, movement, or release of the object.
- 13) The object must be released at the proper location and with the correct orientation (objects that bounce out of the box are considered failures).
- 14) The participant must use **only one hand** for acquisition, movement and release.

Item	Grip type allowed (see manual for details)	Number of items successfully handled	
		Date	
PEG	The thumb and another finger		
WEIGHT	The thumb and another finger		
FORK	The thumb and index finger		
BLOCK	Thumb and index finger (pinch) - OR - Gross grasp		
CAN	Grasp by the can sides The top exposed as if they would drink from it.		
VIDEOTAPE	The thumb and any of the other fingers (including key pinch).		
SUM SCORE			