Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP)

Assessment Overview

Assessment Area

ICF Domain:
Body Function & Structures
Subcategory:
Neuromusculoskeletal & Movement-Related Functions & Structures
Subscales (domains):
Sensation
Strength
Prehension

You Will Need

Length:
Sensation: 3 dorsal locations and 3 palmar locations for each hand
Strength: 10 arm and hand muscles for each arm
Prehension: 3 grasping tasks; 6 prehension tasks for each arm
Equipment:
GRASSP kit and manual muscle test equipment
Scoring:
Scores for tasks in each section are summed for each subscale score. There is no total score.
Training:
Reading the GRASSP manual is recommended.

Summary

The Graded Redefined Assessment of Strength, Sensibility and Prehension (GRASSP) is a clinical impairment measure that incorporates three domains vital to upper limb function: sensation, strength, and prehension. It is a multimodal test comprising 5 subtests for each upper limb: dorsal sensation, palmar sensation, strength, prehension ability and prehension performance. The GRASSP results in 5 numerical scores that provide a comprehensive profile of upper-limb function.

A remote version (rGRASSP) and a version for people with degenerative cervical myelopathy have been developed. Further, a GRASSP v.2 was modified from its original version to improve objectivity, reduce assessment time, and improve usability:

- GR-Str: Isotonic Manual Muscle Testing (MMT) changed to isometric MMT.
- GR-Sens: Reduction of 6 test locations to 3 per hand (elimination of dorsal sensation).
- GR-PP: Reduction of 6 items to 4 items.
- Instruction manual revised for clarity and standardization.

Availability

Worksheet: Can be purchased here.

Language: English.

Assessment Interpretability

Minimal Clinically Important Difference

Not established in SCI

Statistical Error

Standard Error of Measurement:
Strength: Right=1.8, Left=1.9
Sensation: No data available
Prehension ability: R=0.6, L=0.6
Prehension performance: R=2.5, L=1.8

Minimal Detectable Change:
Strength: Right=5.1, Left=5.3
Sensation: No data available

Typical Values

Mean (SD) Scores:
Strength: Right=24.3 (13), Left=25.1 (13.5)
Dorsal Sensation: R=6.5 (3.2), L=6.7 (3.1)
Palmar Sensation: R=7.1 (3.6), L=7.2 (3.3)
Prehension ability: R=4.9 (4.5), L=5.1 (4.3)

	Prehension ability: R=1.8, L=1.7 Prehension performance: R=7.0, L=4.9 (Kalsi-Ryan et al. 2012; n=72; mean (SD) age: 39.7 (10.7) years; traumatic tetraplegia; 38.8% ASIA A, 25.2% ASIA B, 16.6% ASIA C, and 19.4% ASIA D; mean (SD) time since injury: 7.6 (6.1) years)	Prehension performance: R=15.6 (9.6), L=14.7 (8.9) (Kalsi-Ryan et al. 2012; n=72; mean (SD) age: 39.7 (10.7) years; traumatic tetraplegia; 38.8% ASIA A, 25.2% ASIA B, 16.6% ASIA C, and 19.4% ASIA D; mean (SD) time since injury: 7.6 (6.1) years)

Measurement Properties

Validity – Moderate to High

Moderate to High correlation between the GRASSP subtests, SCIM-self care, & ASIA UEMS:

At 1-month post-injury:

Strength & SCIM-self-care: r = 0.78

Strength & ASIA UEMS: r = 0.95

Sensation & SCIM-self-care: r = 0.63

Prehension performance & SCIM-self-care: r = 0.85

At 12-month post-injury:

Strength & SCIM-self-care: r = 0.82

Strength & ASIA UEMS: r = 0.88

Sensation & SCIM-self-care: r = 0.56

Prehension performance & SCIM-self-care: r = 0.82

Moderate to High predictive validity:

ROC analysis AUC: r = 0.71-0.86

(Velstra et al. 2015; n=74, 51 males, 23 females; mean (SD) age: 49 (18) years; traumatic and non-traumatic; 18 ASIA A, 12 ASIA B, 10 ASIA C, and 34 ASIA D; tetraplegia; and 16-40 days post-injury)

Moderate to High correlation between GRASSP and CUE-Q:

r=0.40-0.84

Moderate to High correlation between GRASSP and SCIM/SCIM-SC:

SCIM: r=0.37-0.70

SCIM-SC: r=0.40-0.84

(Mulcahey et al. 2017; n=47; 28 males, 19 females; children (3-17 years); tetraplegia; 14 ASIA A, 4 ASIA B, 10 ASIA C, 8 ASIA D, and 11 unknown)

Moderate to High correlation to SCIM

0.530–0.830, P < 0.0001

(Kalsi-Ryan et al. 2019; Crosssectional: n=72, AIS 28A, 18B, 14C, 12D; Longitudinal: n=127, AIS: 29A, 17B, 26C, 55D)

Number of studies reporting validity data: 9

Reliability – High

High Test-retest Reliability for all domains of the GRASSP:

ICC = 0.86-0.99

(Kalsi-Ryan et al. 2012; n=72; mean (SD) age: 39.7 (10.7) years; traumatic tetraplegia; 38.8% ASIA A, 25.2% ASIA B, 16.6% ASIA C, and 19.4% ASIA D; mean (SD) time since injury: 7.6 (6.1) years)

(Mulcahey et al. 2017; n=47; 28 males, 19 females; children (3-17 years); tetraplegia; 14 ASIA A, 4 ASIA B, 10 ASIA C, 8 ASIA D, and 11 unknown)

High Inter-rater Reliability for all domains of the GRASSP:

ICC = 0.84-0.96

(Kalsi-Ryan et al. 2012; n=72; mean (SD) age: 39.7 (10.7) years; traumatic tetraplegia; 38.8% ASIA A, 25.2% ASIA B, 16.6% ASIA C, and 19.4% ASIA D; mean (SD) time since injury: 7.6 (6.1) years)

High Inter-rater Reliability comparison r-GRASSP total score to examiner 1 vs 2:

ICC = 0.99 (range: 0.98, 0.99) 95% CI

(Voss et al. 2023, n=61; 43 males, 18 females; mean (SD) age: 49 (15) years; 6 ASIA A, 7 ASIA B, 12 ASIA C, 35 ASIA D; level of injury: C1-T1; and mean (SD) time since injury: 0.6 (44.3) years)

Number of studies reporting reliability data: 4

Responsiveness

Floor/Ceiling Effect:
Not established in SCI

Effect Size:
Between 1-12 months post-injury:
Strength: 1.48
Sensation: 0.64
Prehension ability: 0.99
Prehension performance: 1.03

(Velstra et al. 2015; n=74, 51 males, 23 females; mean (SD) age: 49 (18) years; traumatic and non-traumatic; 18 ASIA A, 12 ASIA B, 10 ASIA C, and 34 ASIA D; tetraplegia; and 16-40 days post-injury)

Number of studies reporting responsiveness data: 2