

Supplementary Table S1. Consistency of the MDIVQAS for repeated measures to assess hand function.

Movement (n = 24)	First measurement	Second measurement	Third measurement	F	p
Wrist ulnar deviation	23.00 (4.75 - 32.75)	21.50 (6.25 - 32.75)	19.50 (4.75 - 30.75)	0.326	0.711
Wrist dorsiextension	35.50 (21.25 - 43.50)	36.50 (15.75 - 43.50)	32.50 (20.50 - 44.75)	2.489	0.098
Finger adduction and abduction	113.00 (58.00 - 146.75)	98.00 (62.25 - 149.25)	119.00 (43.75 - 139.25)	0.430	0.643
Forearm pronation	82.50 (25.50 - 88.00)	83.00 (27.00 - 86.75)	79.00 (22.00 - 87.00)	0.976	0.374
Forearm supination	81.00 (13.00 - 88.00)	79.00 (10.50 - 88.00)	78.00 (14.50 - 88.00)	1.666	0.204
Cylindrical grip	13.00 (4.50 - 19.75)	12.50 (4.75 - 19.00)	14.00 (5.25 - 21.00)	2.858	0.071
Spherical grip	36.00 (7.00 - 69.50)	39.00 (9.25 - 64.75)	38.50 (5.00 - 65.75)	0.214	0.753
Thumb abduction	15.00 (4.50 - 23.75)	16.50 (3.75 - 22.75)	17.00 (5.50 - 23.00)	3.348	0.120
Thumb flexion and extension	44.00 (12.25 - 65.00)	43.50 (9.25 - 62.75)	41.00 (11.50 - 63.75)	0.066	0.925
Thumb rotation	28.00 (10.00 - 39.75)	24.00 (7.75 - 38.00)	27.50 (10.00 - 37.25)	3.603	0.045*

Note: * $p < 0.05$.**Supplementary Table S2.** Correlation between MDIVQAS and FMA-W/H, Brunnstrom (hand), and ARAT

Evaluation methods	FMA-UE (n = 82)	FMA- W/H (n = 82)	Brunnstrom (hand) (n = 72)	ARAT (n = 36)
Multi-dimensional intelligent visual quantitative assessment system	0.690**	0.796**	0.895**	0.747**
Correlation coefficient (R)				
<i>p</i>	0.000	0.000	0.000	0.000

Note: * $p < 0.05$, ** $p < 0.01$.**Supplementary Table S3.** Correlations between MDIVQAS and protractor measurement.

Movement	r	p
Forearm pronation (n=81)	0.974**	0.000
Forearm supination (n=81)	0.973**	0.000
Ulnar deviation of wrist (n=81)	0.763**	0.000
wrist dorsiextension (n=81)	0.790**	0.000
Finger adduction and abduction1 (n=37)	0.832**	0.000
Finger adduction and abduction2 (n=37)	0.916**	0.000
Finger adduction and abduction3 (n=37)	0.748**	0.000
Finger adduction and abduction4 (n=37)	0.815**	0.000
Sum of finger adduction and abduction (n=37)	0.908**	0.000

Note: * $p < 0.05$, ** $p < 0.01$; finger adduction abduction 1: angle between the thumb and index finger of the affected hand, finger adduction and abduction 2: angle between the index finger and the middle finger of the affected hand, finger adduction and abduction 3: angle between the middle finger and the ring finger of the affected hand, finger adduction and abduction 4: angle between the ring finger and the little finger of the affected hand.

Supplementary Table S4. Comparison of differences between FMA-UE, FMA-W/H, Brunnstrom and ARAT before and after treatment.

	Before the treatment (n = 46)	After treatment (n = 46)	t	p values	95%CI
FMA-UE	39.67±15.977	48.44±17.118	-4.233**	0.003	-13.559~-3.996
FMA-W/H	14.00±6.500	17.78±7.965	-3.640**	0.007	-6.171~-1.384
Brunnstrom (hand)	3.07±1.597	3.87±1.771	-7.284**	0.000	-1.027~-7.284
Brunnstrom (upper limb)	3.46±1.361	4.24±1.369	-7.622**	0.000	-0.989~-0.576
ARAT	40.00±17.692	44.00±18.486	-2.502*	0.037	-7.686~-0.314

Note:*p < 0.05,**p < 0.01.

Supplementary Table S5. Comparison the differences of the AROM in finger adduction and abduction. With protractor before and after rehabilitation treatment

Movement	Before treatment (n = 37)	After treatment (n = 37)	Z	p values
Finger adduction and abduction 1	10 (0 to 40)	25 (0 to 48)	3.157**	0.002
Finger adduction and abduction 2	5 (0 to 20)	15 (0 to 23)	2.905**	0.004
Finger adduction and abduction 3	5 (0 to 12.5)	6 (0 to 17)	2.766**	0.006
Finger adduction and abduction 4	2 (0 to 20)	15 (0 to 22.5)	2.747**	0.006
Sum of finger adduction and abduction	32 (0 to 152)	100 (0 to 166)	3.971**	0.000

Note:**p < 0.01, finger adduction abduction 1: angle between the thumb and index finger of the affected hand, finger adduction and abduction 2: angle between the index finger and the middle finger of the affected hand, finger adduction and abduction 3: angle between the middle finger and the ring finger of the affected hand, finger adduction and abduction 4: angle between the ring finger and the little finger of the affected hand. Z represents the effect size of the two-sample K-S test.

Supplementary Table S6. Comparison of differences before and after rehabilitation treatment using MDIVQAS

action	Before the treatment (n = 47)	After treatment (n = 47)	Z	p values
Wrist ulnar deviation	48.39 (14.78-65.58)	46.15 (10.34-70.27)	2.621**	0.008
Wrist dorsioextension	47.21 (14.46 to 74.52)	61.29 (20.41-84.62)	2.961**	0.002
Forearm pronation	91.48 (41.19 to 100.00)	86.36 (40.91 ~ 100.00)	2.233*	0.024
Forearm supination	80.11 (13.75 to 100.00)	88.75 (8.11 ~ 100.00)	3.393**	0.001
Cylindrical grip	46.59 (16.19 to 74.32)	58.33 (23.53-83.87)	3.852**	0.000
Spherical grip	45.36 (11.42 to 75.55)	69.40 (14.73-87.73)	2.839**	0.004
Thumb abduction	40.67 (20.63 to 68.34)	58.97 (8.33-82.14)	2.177*	0.029
Thumb flexion and extension	95.09 (32.42 to 146.20)	100.52 (12.55 ~ 159.70)	2.788**	0.005
Thumb rotation	54.25 (15.94 to 84.22)	66.33 (15.93-85.54)	2.904**	0.004
Finger adduction and abduction 1	31.82 (6.85 to 69.99)	45.64 (12.44 ~ 91.48)	3.077**	0.002
Finger adduction and abduction 2	25.00 (9.55 to 62.50)	43.99 (13.84 ~ 83.75)	2.178*	0.029
Finger adduction and abduction 3	25.93 (7.28 to 51.19)	50.84 (8.08 to 69.11)	3.115**	0.002
Finger adduction and abduction 4	32.50 (6.07 to 56.02)	47.81 (12.26 ~ 68.61)	2.510*	0.012
Sum of finger adduction and abduction	195.47 (37.55 to 329.37)	286.10 (53.59 ~ 400.46)	3.554**	0.000

Note:*p < 0.05,*p < 0.01.