

Table S1: Baseline characteristics of participants who responded<sup>||</sup> at each follow-up time point

Characteristic	Baseline N=257	3-months N=232	6-months N=218	12-months N=219
Demographic data				
General practice				
A	16 (6)	12 (5)	13 (6)	14 (6)
B	39 (15)	36 (16)	33 (15)	34 (16)
C	67 (26)	63 (27)	63 (29)	60 (27)
D	62 (24)	56 (24)	53 (24)	53 (24)
E	73 (28)	65 (28)	56 (26)	58 (26)
Mean (SD): Age (years)	65.8 (9.1)	66.4 (9.2)	66.2 (9.1)	65.6 (9.0)
Female	170 (66)	152 (66)	147 (67)	149 (68)
Married	165 (65)	145 (63)	140 (65)	138 (64)
Routine or manual occupation* <sup>†</sup>	121 (47)	107 (46)	96 (44)	103 (47)
Currently working	76 (30)	64 (28)	60 (28)	64 (29)
Mean (SD): Age when left school	16 (1.2)	16 (1.2)	16 (1.2)	16 (1.2)
Left school to go to full time education or university	41 (16)	37 (16)	37 (17)	35 (16)
Gained qualifications through study as an adult	126 (50)	113 (50)	111 (52)	112 (52)
General health and quality of life				
Body mass index $\geq 25.0$ kg/m <sup>2</sup> (overweight/obese) <sup>‡</sup>	169 (68)	150 (67)	143 (68)	143 (68)
Mean (SD): SF-12: Physical component (0-100) <sup>*</sup>	40.1 (10.7)	40.1 (10.7)	40.1 (10.7)	40.5 (10.6)
Median (IQR): SF-12: Mental component (0-100) <sup>*</sup>	53.4 (43.3, 59.2)	53.8 (44.5, 59.3)	53.8 (44.0, 59.3)	53.7 (43.9, 59.4)
Clinical characteristics of hand problem				
Pain in both hands in last 12 months	225 (88)	202 (87)	193 (89)	195 (89)
Median (IQR): Number of years with hand problem <sup>*</sup>	5.0 (2.0, 10.0)	5.0 (2.0, 10.0)	5.0 (2.4, 10.0)	5.0 (2.0, 10.0)
Mean (SD): AUSCAN - pain (0-20) <sup>*</sup>	9.4 (3.6)	9.3 (3.7)	9.3 (3.6)	9.4 (3.6)
Mean (SD): AUSCAN - stiffness (0-4) <sup>*</sup>	1.5 (1.0)	1.5 (1.0)	1.5 (1.1)	1.5 (1.0)
Mean (SD): AUSCAN - function (0-36) <sup>*</sup>	14.8 (7.6)	14.6 (7.6)	14.8 (7.5)	14.7 (7.4)
Mean (SD): AUSCAN - total (0-12) <sup>*</sup>	5.0 (2.2)	5.0 (2.2)	5.0 (2.2)	5.0 (2.2)
Mean (SD): Arthritis self-efficacy pain subscale (1-10) <sup>*</sup>	5.1 (1.8)	5.1 (1.8)	5.1 (1.8)	5.1 (1.8)
Mean (SD): Hand pain severity on average last 3 days (0-10) <sup>*</sup>	4.6 (2.0)	4.6 (2.0)	4.6 (2.0)	4.6 (2.0)
Mean (SD): Severity of main functional problem, on average, last 3 days (0-10) <sup>*</sup>	5.0 (2.4)	5.0 (2.4)	5.1 (2.4)	5.1 (2.4)
Mean (SD): Satisfaction with hand function last 3 days (0-10) <sup>*</sup>	4.8 (2.3)	4.8 (2.3)	4.8 (2.3)	4.8 (2.2)
Median (IQR): Grip strength (lbs) <sup>*</sup>	33.5 (22.5, 47.5)	33.5 (22.5, 48.0)	32.5 (22.0, 47.5)	32.5 (21.5, 47.5)

Mean (SD): Pinch strength (lbs) <sup>*</sup>	8.9 (3.4)	9.0 (3.4)	8.9 (3.4)	8.9 (3.4)
Median (IQR): Grip ability test (seconds) <sup>*</sup>	32.0 (26.5, 40.4)	32.1 (26.5, 40.7)	32.1 (26.0, 41.5)	32.1 (26.4, 41.3)
ACR criteria met <sup>§</sup>	230 (90)	208 (90)	195 (89)	194 (89)
Unilateral or bilateral thumb OA	210 (82)	193 (83)	182 (84)	183 (84)

Figures are numbers and percentages unless otherwise stated. Median (IQR) given for outcome measures with a skewed distribution. Total AUSCAN score calculated as (pain/5) + stiffness + (function/9). Abbreviations: SF-12 = Short Form Health Survey 12 (version 2), AUSCAN = Australian/Canadian Hand Osteoarthritis Index, ACR = American College of Rheumatology, OA = osteoarthritis. \* = Data based on imputed data; † = Based on the “lower supervisory/technical”, “Semi-routine” and “Routine” groups of the UK Standard Occupation Classification (2000) for current or most recent paid employment; ‡ = Body mass index grouping defined according to the World Health Organisation (WHO); § = ACR criteria based on clinical features only (symptom frequency assessed prior to clinical assessment); || = Responding is defined as participants who return the self-complete questionnaire or complete minimum data at the respective time point.

Table S2: Interaction effects for the primary outcome measure

	3-months		6-months		12-months	
	N (%)	Interaction coefficient (95% CI)	N (%)	Interaction coefficient (95% CI)	N (%)	Interaction coefficient (95% CI)
OARSI responder criteria						
Leaflet and advice (L&A)	8 (12)		14 (22)		9 (14)	
Joint protection (JP)	16 (26)	0.29	17 (28)	1.81	15 (24)	0.50
Hand Exercises (HEX)	15 (23)	(0.07, 1.25)	13 (20)	(0.53, 6.22)	18 (27)	(0.13, 1.92)
Combined therapy (JP&HEX)	11 (17)		24 (37)		20 (30)	

Descriptive statistics based on unadjusted imputed data; interaction coefficients on adjusted imputed data (i.e. adjusted for age, gender, social class, length of time with a hand condition, general practice and the two main effects of interest. Interaction coefficients are odds ratios from logistic regression models; confidence intervals containing one are non-significant interactions. Abbreviations: CI = confidence interval

Table S3: Frequencies of the global assessment of change question (percentages estimated from imputed data)

Global assessment of change				
	No JP N=130	JP N=127	No HEx N=127	HEx N=130
3-months				
Completely better/much better	10 (8)	9 (7)	9 (7)	10 (8)
Better	29 (22)	36 (28)	20 (16)	43 (33)
No change	61 (47)	66 (52)	74 (58)	53 (41)
Worse/much worse	29 (22)	18 (14)	23 (18)	23 (18)
6-months				
Completely better/much better	9 (7)	11 (9)	6 (5)	14 (11)
Better	21 (16)	39 (31)	20 (16)	39 (30)
No change	62 (48)	55 (43)	69 (54)	48 (37)
Worse/much worse	38 (29)	20 (16)	32 (25)	27 (21)
12-months				
Completely better/much better	10 (8)	13 (10)	9 (7)	14 (11)
Better	23 (18)	33 (26)	20 (16)	36 (28)
No change	47 (36)	48 (38)	55 (43)	40 (31)
Worse/much worse	49 (38)	33 (26)	43 (34)	39 (30)

Figures are number (percentages).

JP = joint protection, HEx = hand exercise

Supplementary Table S4: Treatment fidelity

	3-months		6-months		12-months	
	No HEx	HEx	No HEx	HEx	No HEx	HEx
<b>Hand exercise fidelity</b>						
Last week, frequency of completion of a structured exercise program						
Never	47 (43)	11 (10)	46 (44)	8 (8)	35 (34)	11 (10)
Almost never	16 (15)	2 (2)	18 (17)	11 (11)	16 (16)	8 (8)
Sometimes	26 (24)	23 (20)	27 (26)	39 (37)	29 (28)	35 (33)
Fairly often	11 (10)	35 (30)	6 (6)	29 (28)	11 (11)	34 (32)
Very often	7 (6)	38 (33)	4 (4)	14 (13)	8 (8)	17 (16)
Always	3 (3)	6 (5)	3 (3)	4 (4)	3 (3)	2 (2)
Chi-square ( $\chi^2$ ) <sup>1</sup> (d.f.=4)	$\chi^2 = 67.3; p < 0.001$		$\chi^2 = 50.6; p < 0.001$		$\chi^2 = 29.5; p < 0.001$	
Last month, number of times a week done exercises specifically designed for hand problems						
Never	$\alpha$	$\alpha$	38 (37)	15 (14)	37 (37)	12 (11)
Once a week	$\alpha$	$\alpha$	11 (11)	9 (9)	7 (7)	16 (15)
Twice a week	$\alpha$	$\alpha$	3 (3)	21 (20)	5 (5)	22 (21)
Three times a week	$\alpha$	$\alpha$	6 (6)	19 (18)	10 (10)	22 (21)
Four times a week	$\alpha$	$\alpha$	6 (6)	10 (10)	3 (3)	4 (4)
Five times a week	$\alpha$	$\alpha$	2 (2)	4 (4)	2 (2)	6 (6)
Six times a week	$\alpha$	$\alpha$	2 (2)	2 (2)	3 (3)	3 (3)
Once every day	$\alpha$	$\alpha$	19 (18)	12 (12)	19 (19)	11 (10)
Twice every day	$\alpha$	$\alpha$	17 (16)	12 (12)	15 (15)	11 (10)
Chi-square ( $\chi^2$ ) <sup>2</sup> (d.f.=4)			$\chi^2 = 25.6; p < 0.001$		$\chi^2 = 34.2; p < 0.001$	
When doing hand exercises, how long do you spend doing them?						
Less than 5 minutes	$\alpha$	$\alpha$	44 (43)	30 (28)	37 (39)	29 (28)
Five minutes to less than ten minutes	$\alpha$	$\alpha$	24 (24)	38 (36)	25 (26)	47 (45)
Ten minutes to less than fifteen minutes	$\alpha$	$\alpha$	2 (2)	14 (13)	3 (3)	17 (16)
Fifteen minutes to less than an hour	$\alpha$	$\alpha$	1 (1)	8 (8)	1 (1)	0 (0)
Half an hour or more	$\alpha$	$\alpha$	1 (1)	2 (2)	0 (0)	1 (1)
I don't do hand exercises	$\alpha$	$\alpha$	30 (29)	14 (13)	30 (31)	11 (11)
Chi-square ( $\chi^2$ ) <sup>3</sup> (d.f.=3)			$\chi^2 = 25.8; p < 0.001$		$\chi^2 = 25.1; p < 0.001$	
<b>Joint protection fidelity</b>						

	No JP	JP	No JP	JP	No JP	JP
Energy conservation/fatigue (1-6)[13,22]						
N	114	110	107	103	101	106
Mean (SD)	3.4 (1.2)	3.9 (1.0)	3.4 (1.1)	3.8 (1.0)	3.4 (1.1)	3.8 (1.1)
Adjusted <sup>5</sup> mean difference (95% CI)	0.40 (0.17, 0.63)		0.46 (0.23, 0.69)		0.39 (0.18, 0.60)	
p-value	<b>p=0.001</b>		<b>p &lt;0.001</b>		<b>p &lt;0.001</b>	
Joint protection use (1-6)[13,22]						
N	115	110	107	103	103	106
Mean (SD)	3.4 (1.1)	4.2 (1.0)	3.5 (1.2)	4.2 (1.0)	3.7 (1.2)	4.2 (1.0)
Adjusted <sup>5</sup> mean difference (95% CI)	0.73 (0.52, 0.93)		0.71 (0.48, 0.94)		0.50 (0.27, 0.72)	
p-value	<b>p &lt;0.001</b>		<b>p &lt;0.001</b>		<b>p &lt;0.001</b>	
Carry on working through the pain when doing everyday activities[13,22]						
Never	5 (4)	3 (3)	5 (5)	3 (3)	1 (1)	3 (3)
Almost never	6 (5)	15 (14)	6 (6)	10 (10)	10 (10)	20 (19)
Sometimes	29 (25)	35 (32)	37 (35)	37 (36)	25 (24)	22 (21)
Fairly often	25 (22)	26 (24)	19 (18)	24 (23)	21 (20)	31 (29)
Very often	36 (31)	18 (16)	28 (26)	17 (17)	34 (33)	15 (14)
Always	14 (12)	13 (12)	12 (11)	12 (12)	12 (12)	15 (14)
Chi-square( $\chi^2$ ) <sup>4</sup> (d.f.=4)	$\chi^2 = 8.2$ (p=0.08)		$\chi^2 = 3.4$ (p=0.5)		$\chi^2 = 14.0$ (p=0.007)	

1 = Analysis categories: "Never", "Almost never", "Sometimes", "Fairly often", "Very often or always" due to small N

2 = Analysis categories: "Never", "1-2 times a week", "3-4 times a week", "5-6 times a week", "1-2 times per day" due to small N

3 = Analysis categories: "Never do hand exercises", "< 5-minutes", "5-10 minutes", "10 minutes or more" due to small N

4 = Analysis categories: "Never or almost never", "Sometimes", "Fairly often", "Very often", "Always" due to small N

5 = Adjusted for the baseline for the outcome of interest and the main effect: No HEx vs HEx

$\alpha$  = Data not collected at the 3-month time point

Abbreviations: HEx = Hand exercises, JP = Joint protection. CI = confidence interval, d.f. = degrees of freedom. P-values <0.05 are highlighted

Table S5: Treatment effectiveness for primary and secondary outcome measures by main treatment effects – missing data not imputed

Outcome measure	3-months				6-months				12-months			
	No JP <sup>†</sup>	JP	No HEx <sup>†</sup>	HEx	No JP <sup>†</sup>	JP	No HEx <sup>†</sup>	HEx	No JP <sup>†</sup>	JP	No HEx <sup>†</sup>	HEx
OARSI responder criteria (%)												
N	115	107	112	110	108	108	107	109	100	102	94	108
N (%) meeting responder criteria	16 (14)	23 (22)	20 (18)	19 (17)	20 (19)	35 (32)	24 (22)	31 (28)	20 (20)	30 (29)	18 (19)	32 (30)
Adjusted odds ratio (95% CI)	1.76 (0.83, 3.73)		0.81 (0.39, 1.67)		2.61 (1.32, 5.15)		1.20 (0.62, 2.31)		1.91 (0.95, 3.83)		1.96 (0.98, 3.94)	
Global assessment of change (%)												
N	118	110	115	113	109	109	108	110	103	103	97	109
N (%) improved*	36 (31)	38 (35)	26 (23)	48 (42)	23 (21)	45 (41)	21 (19)	47 (43)	25 (24)	38 (37)	20 (21)	43 (39)
Adjusted odds ratio (95% CI)	1.15 (0.61, 2.17)		2.73 (1.44, 5.18)		3.49 (1.76, 6.92)		3.41 (1.75, 6.66)		2.20 (1.15, 4.22)		2.47 (1.29, 4.74)	
AUSCAN Pain (0-20)												
N	116	109	114	111	109	108	107	110	108	109	103	114
Mean (SD)	9.2 (3.4)	9.2 (3.0)	9.5 (3.4)	8.9 (3.0)	9.5 (3.9)	9.0 (3.9)	9.6 (3.9)	8.9 (4.0)	9.4 (4.0)	9.4 (3.7)	9.7 (3.7)	9.1 (4.0)
Adjusted mean difference (95% CI)	-0.17 (-0.87, 0.53)		-0.26 (-0.95, 0.44)		-0.76 (-1.69, 0.16)		-0.23 (-1.14, 0.69)		-0.36 (-1.28, 0.57)		-0.22 (-1.14, 0.70)	
AUSCAN Stiffness (0-4)												
N	118	110	114	114	109	108	107	110	108	105	103	110
Mean (SD)	1.5 (1.0)	1.4 (1.0)	1.6 (1.0)	1.3 (1.0)	1.6 (1.0)	1.4 (1.0)	1.5 (1.1)	1.5 (1.0)	1.6 (0.9)	1.5 (1.0)	1.7 (0.9)	1.4 (1.0)
Adjusted mean difference (95% CI)	0.00 (-0.20, 0.20)		-0.19 (-0.39, 0.01)		-0.22 (-0.45, 0.00)		0.09 (-0.13, 0.31)		-0.09 (-0.31, 0.14)		-0.19 (-0.41, 0.04)	
AUSCAN Function (0-36)												
N	118	108	112	114	109	108	107	110	108	105	102	111
Mean (SD)	15.2 (7.8)	15.0 (6.9)	15.8 (7.8)	14.4 (6.8)	14.6 (7.9)	15.1 (7.6)	15.7 (7.6)	14.0 (7.9)	15.2 (7.9)	16.1 (7.6)	16.3 (7.6)	15.0 (7.9)
Adjusted mean difference (95% CI)	-1.10 (-2.40, 0.19)		-0.70 (-1.97, 0.57)		-0.79 (-2.33, 0.75)		-0.83 (-2.34, 0.69)		-0.22 (-1.85, 1.40)		-0.74 (-2.35, 0.87)	
AUSCAN Total (0-12)												
N	115	107	112	110	109	108	107	110	106	104	100	110
Mean (SD)	5.1 (2.1)	4.9 (1.9)	5.2 (2.2)	4.7 (1.9)	5.1 (2.4)	4.9 (2.4)	5.2 (2.4)	4.8 (2.3)	5.2 (2.3)	5.2 (2.4)	5.4 (2.2)	4.9 (2.4)
Adjusted mean difference (95% CI)	-0.19 (-0.58, 0.19)		-0.30 (-0.69, 0.08)		-0.47 (-0.97, 0.02)		-0.03 (-0.52, 0.46)		-0.20 (-0.72, 0.32)		-0.30 (-0.82, 0.21)	
Arthritis self-efficacy for pain (1-10)												
N	114	110	110	114	107	103	104	106	101	104	100	105
Mean (SD)	5.6 (1.9)	6.3 (1.7)	5.7 (2.0)	6.1 (1.6)	5.7 (1.9)	6.5 (1.7)	6.0 (1.8)	6.2 (1.8)	5.4 (2.0)	6.0 (1.7)	5.6 (1.8)	5.8 (2.0)
Adjusted mean difference (95% CI)	0.78 (0.36, 1.21)		0.17 (-0.24, 0.59)		0.81 (0.37, 1.25)		0.24 (-0.19, 0.68)		0.66 (0.18, 1.15)		0.16 (-0.31, 0.64)	
Hand pain severity last 3 days (0-10)												
N	115	109	109	115	104	95	96	103	102	103	101	104
Mean (SD)	4.4 (2.2)	4.2 (1.9)	4.6 (2.2)	4.1 (1.9)	4.1 (2.2)	4.4 (2.1)	4.1 (2.0)	4.3 (2.3)	4.5 (2.2)	4.6 (2.3)	4.8 (2.2)	4.2 (2.3)
Adjusted mean difference (95% CI)	-0.30 (-0.77, 0.16)		-0.19 (-0.65, 0.27)		-0.02 (-0.54, 0.51)		0.42 (-0.09, 0.94)		-0.12 (-0.68, 0.44)		-0.31 (-0.86, 0.24)	

Severity of worse problem in the last 3-days (0-10)												
N	114	108	108	114	101	93	95	99	101	102	101	102
Mean (SD)	4.7 (2.3)	4.6 (2.2)	5.0 (2.3)	4.4 (2.2)	4.8 (2.4)	4.7 (2.6)	4.9 (2.5)	4.7 (2.4)	4.9 (2.2)	4.7 (2.5)	5.2 (2.2)	4.4 (2.4)
Adjusted mean difference (95% CI)	-0.24 (-0.76, 0.29)		-0.42 (-0.94, 0.09)		-0.63 (-1.26, 0.00)		-0.08 (-0.70, 0.55)		-0.50 (-1.09, 0.09)		-0.62 (-1.19, -0.04)	
Satisfaction with hand function in the last 3 days (0-10)												
N	115	108	109	114	104	95	96	103	103	103	101	105
Mean (SD)	4.7 (2.3)	4.3 (2.2)	4.9 (2.4)	4.2 (2.1)	4.5 (2.4)	3.9 (2.3)	4.2 (2.4)	4.3 (2.4)	4.9 (2.3)	4.7 (2.4)	5.2 (2.2)	4.4 (2.4)
Adjusted mean difference (95% CI)	-0.48 (-1.03, 0.06)		-0.52 (-1.06, 0.02)		-0.79 (-1.41, -0.18)		0.33 (-0.28, 0.93)		-0.30 (-0.89, 0.29)		-0.58 (-1.17, 0.00)	
Grip strength (lbs)												
N	N/A	N/A	N/A	N/A	104	95	96	103	N/A	N/A	N/A	N/A
Mean (SD)	N/A	N/A	N/A	N/A	42.9 (23.5)	39.8 (20.5)	39.9 (21.7)	42.8 (22.5)	N/A	N/A	N/A	N/A
Adjusted mean difference (95% CI)	N/A		N/A		-0.44 (-3.29, 2.42)		1.57 (-1.27, 4.41)		N/A		N/A	
Pinch strength (lbs)												
N	N/A	N/A	N/A	N/A	103	95	96	102	N/A	N/A	N/A	N/A
Mean (SD)	N/A	N/A	N/A	N/A	9.2 (3.6)	8.9 (3.6)	8.7 (3.4)	9.3 (3.7)	N/A	N/A	N/A	N/A
Adjusted mean difference (95% CI)	N/A		N/A		-0.18 (-0.75, 0.39)		0.26 (-0.31, 0.82)		N/A		N/A	
Grip ability test (GAT) (seconds)												
N	N/A	N/A	N/A	N/A	104	95	96	103	N/A	N/A	N/A	N/A
Mean (SD)	N/A	N/A	N/A	N/A	33.7 (20.4)	31.0 (10.2)	34.5 (20.9)	30.4 (10.2)	N/A	N/A	N/A	N/A
Adjusted mean difference (95% CI)	N/A		N/A		-1.01 (-3.41, 1.39)		-0.82 (-3.20, 1.56)		N/A		N/A	
SF-12: physical component (0-100)												
N	113	104	105	112	106	101	102	105	100	100	100	100
Mean (SD)	40.7 (10.9)	40.4 (10.2)	39.9 (11.2)	41.2 (9.8)	41.6 (10.7)	40.2 (10.3)	40.2 (10.9)	41.7 (10.1)	41.4 (10.8)	41.1 (10.4)	40.4 (10.4)	42.2 (10.7)
Adjusted mean difference (95% CI)	0.97 (-0.89, 2.84)		0.59 (-1.25, 2.43)		0.05 (-1.93, 2.02)		1.18 (-0.75, 3.11)		0.08 (-1.89, 2.06)		1.24 (-0.71, 3.19)	
SF-12: mental component (0-100)												
N	113	104	105	112	106	101	102	105	100	100	100	100
Mean (SD)	50.4 (10.8)	51.5 (9.9)	51.1 (10.4)	50.7 (10.3)	50.8 (9.9)	52.5 (9.7)	51.8 (10.4)	51.4 (9.2)	51.0 (10.7)	52.3 (10.2)	51.5 (11.1)	51.8 (9.7)
Adjusted mean difference (95% CI)	-1.37 (-3.37, 0.63)		0.00 (-1.96, 1.96)		-0.52 (-2.59, 1.56)		0.44 (-1.59, 2.46)		-0.58 (-2.86, 1.70)		1.03 (-1.23, 3.28)	

Abbreviations: CI = confidence interval, JP = joint protection, HEx = hand exercise, N/A = not applicable, AUSCAN = Australian Canadian Hand Osteoarthritis Index, SF-12 = Short Form Health Survey 12 (version 2). \* = "Improved" defined as "completely better", "much better", or "better" on the global assessment of change question; † = Reference category. Results are adjusted for baseline (except for measures derived using the global assessment of change), age, gender, social class, GP practice, length of time with a hand condition and the other main effect of interest. Total AUSCAN score calculated as (pain/5) + stiffness + (function/9)



Table S6: Per-protocol analysis of the primary outcome (OARSI) responder criteria at the primary endpoint (6-month follow-up)

Outcome measure	6-months			
	No JP*	JP	No HEx*	HEx
N	109	85	107	87
“Responders” (OARSI), n (%)	24 (22)	29 (34)	26 (24)	27 (31)
Adjusted <sup>3</sup> odds ratio (95% CI)	1.95 (0.94, 4.02)		1.47 (0.73, 2.96)	

Footnote: Analysis was defined to be per protocol if participants were in the leaflet and advice arm or attended: session 1, 2, 3 & 4; sessions 1, 2 & 4; sessions 1, 3 & 4; or sessions 1 & 4 for the OT intervention arms. JP = joint protection, HEx = hand exercise, CI = confidence interval. \* = reference category