Supplementary files

Supplement 1: Occupational therapy interventions

1. Patient education booklet including treatment diary

The patients received an education booklet that provided education on HOA, the use of assistive devices, the rationale and use of day and night orthoses, the hand exercise programme, and a treatment diary*.
Information on OA, in general, was followed by information on diagnoses, symptoms, pain, movement, and joint strain in HOA. In addition, a description was given of ergonomic principles and techniques and examples of how to use the five assistive devices, with the aim of improving activity performance and self-management in CMCJ OA.

Patient education booklet	
Pages	**Content**
4*	Brief information on osteoarthritis. Diagnosis, symptoms, pain, movement and strain of the joints in hand osteoarthritis.
5-7 8	Information about ergonomic principles and use of assistive devices, illustrated with photos of ergonomic techniques and use of the five assistive devices provided as part of the occupational therapy intervention.
9	Information about the rationale for using orthoses, with pictures of the day and night orthoses. Pictures of activities performed with the day orthosis.
10	Information about the rationale for hand exercising, and general advice regarding how to design an exercise plan, the importance of sitting comfortably, remembering to breathe and keep the shoulders low while performing the hand exercises, and instructions for the warm-up period. Information regarding the weekly frequency, number of repetitions and intensity of each exercise, and how to adjust the programme in the exercise period.
11	Exercise plan, in which participants will be encouraged to write down when (day and time) they will exercise.
12-13	The exercise programme.
14-17	Four pages (one for each week) which each contains: • three sections with an 11-point Numeric Rating Scale (NRS) in which the participants will report date and length of exercise session, rate their pain immediately after exercising (0=no pain, 10=unbearable pain), and give written comments • one section with each day of the week where participants will record days and nights with using orthosis and length of use (day and night) in hours and minutes.
18	A text stating that “you have now finished 1/3 of the programme”, together with a cartoon and an exercise plan which the participant may use if she/he needs to revise her/his original plan.
19 - 22	Four more pages (one for each week) for recording offhand exercising, pain immediately after exercising, and use of day and night orthoses.
23	A text stating that “you have now finished 2/3 of the programme”, together with a cartoon and an exercise plan which the participant may use if she/he needs to revise her/his original plan.
24-27	Four more pages (one for each week) for recording off hand exercising, pain immediately after exercising, and use of day and night orthoses.
28	A last page with a text encouraging participant to continue to exercise two to three times a week, and a reminder that they must bring the treatment diary to the next occupational therapy appointment. *The information at page 4 was also given to the control group.

2. Assistive devices

Five assistive devices:

- Bread knife
- Vegetable knife with a built-up handle
- Enlarged grip for opening bottles
- Key for opening jars (the Jar Key)
- Self-opening scissors

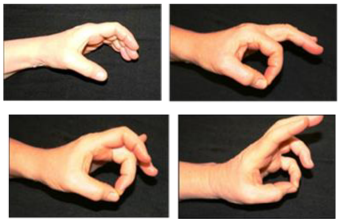
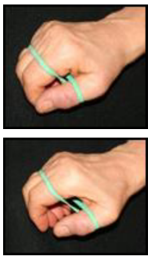
3. Day and night orthoses

The design of the day orthosis depended on the degrees of CMCJ OA, deformity, and subluxation of the thumb; it was either prefabricated or custom-made. The first choice was the Push BraceTM orthosis. This small, water resistant, rigid, pre-fabricated orthosis supported the CMCJ, but allowed optimal mobility of the wrist and fingers, thereby providing pain relief and support in activities. The night orthosis was a short, rigid, custom-made thumb orthosis designed to prevent thumb subluxation and adduction. Patients were encouraged to use the orthoses as much as possible, both during the day and at night.

 First choice of day orthosis; the Push Brace™ orthosis.	 Alternative day orthosis; Camp 28558 thumb orthosis with Orfit 2mm inserted around the CMCJ and MCPJ to provide extra support to these joints.
 Alternative day orthosis; a custom made CMC1 orthosis made in 2 mm Orfit material to support the CMCJ.	 Night orthosis made of Orfit Classic 2 mm Maxi and lined with Velour Cotton.

4. Hand exercise program

The patients received a rationale for the exercises together with instructions on frequency, intensity, and possible adjustments. The exercise programme aimed to improve grip strength and thumb stability and to maintain finger range of motion. The programme followed the American College of Sport Medicine's recommendations[2] regarding exercise dosage. The programme consisted of eight exercises and a warm-up session.

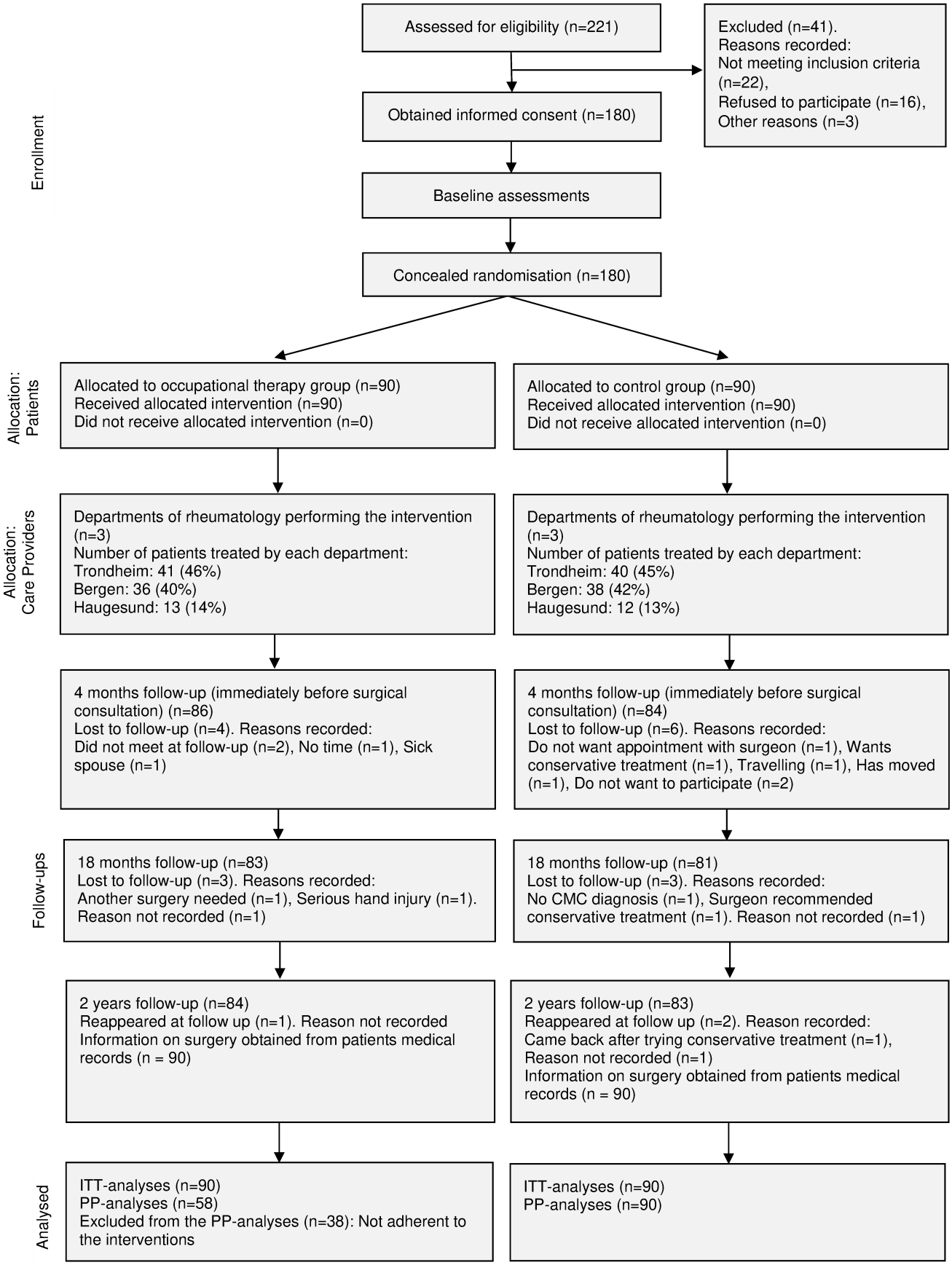
Instructions	
Warming up: Warm up your hands by rubbing them in with hand cream.	
Exercises for hand mobility	
1. **Opening grip:** Put your hands on the table with the thumb up. Open your hands as if to grab a bottle. All joints shall be slightly flexed. Repeat 5 times for the first 2 weeks, thereafter increase to 10 repetitions.	
2. **Make an "O-sign":** Keep the thumb IP and MCP joints slightly flexed throughout. First, open the hand as if grabbing a bottle. Bring the thumb tip to the tip of the index finger, keeping the MCP, PIP and DIP joints flexed. Open the hand again ("grab the bottle"). Repeat with the 3rd, 4th and 5th fingers. Repeat 5 times for the first two weeks, thereafter increase to 10 repetitions.	
3. **Roll into a fist:** First, flex the 2nd to 5th DIPs and PIPs only (keep the MCPs extended). Then flex the MCPs. Hold for 5 seconds. Reverse: extend the MCPs only, then the PIPs and DIPs. Repeat 5 times for the first two weeks, thereafter increase to 10 repetitions.	
Exercises for strength and joint stability	
4. **Thumb stability, abduction/extension (exclude if CMC1-joint is very painful):** Rest your hand rest on a surface. Place a rubber band in figure eights around your thumb just below the outer joint and around the fingers as shown in the picture (between the PIP and MCP-joints). Keep the MCP and IP joints of the thumb flexed while abducting/extending the thumb. The abducted position is maintained for 5 seconds. Start with 10 repetitions and increase to 15. As you are getting stronger, you may also change to a thicker rubber band, or you may use two or more thinner bands together. Repeat 5 times for the first two weeks, thereafter increase to 10 repetitions.	

5. **Grip strength:** Squeeze a pipe insulation tube as hard as possible (isometric hold) for 10 seconds. Start with 10 repetitions and go down to 5 repetitions as you become stronger.	
6. **Wrist stability:** Hold an exercise band (TheraBandTM) between your hands and pull out the band. The wrists shall be held in a neutral position while pulling the band (as at the picture). Pull – hold for 5 to 10 seconds – and slowly let go. Start with 5 repetitions and increase to 10 after two weeks. Remember that your shoulders shall be low during the exercise.	 
Stretching exercises	
7. **Thumb stretching:** Spread all the fingers, including the thumb, for 5 seconds, and then move the fingers together again. Repeat three times.	
8. **Finger stretching:** Put your hand on the table with the palm facing down. Put your other hand on top and press the PIP and DIP-joints down against the table. Hold for 30 seconds. Repeat three times. **Alternative**: If direct pressure on the joints is painful, put one finger at each side of the PIP and DIP joint and push down against the table. Repeat for each finger.	 

References:

1. American College of Sports Medicine Position Stand. The recommended quantity and quality of exercise for developing and maintaining cardiorespiratory and muscular fitness, and flexibility in healthy adults. *Med Sci Sports Exerc.* 1998;30(6):975-91.
2. Kjeken I, Eide REM, Klokkeide Å, et al. Does occupational therapy reduce the need for surgery in carpometacarpal osteoarthritis? Protocol for a randomized controlled trial. *BMC Musculoskelet Disord.* 2016;17(1):473.

Supplement 2: Study flow diagram



Supplement 3: Adverse events

Adverse events

Of 17 patients that experienced discomfort, one experienced discomfort related to both orthosis use and exercise performance.

Patients that experienced minor adverse events related to the orthoses (n=5):

- Pain (n=1)
- Discomfort (n=2)
- Pressure (n=1)
- Eczema and wound (n=1)

Patients that experienced minor adverse events related to the exercise programme (n=2):

- Pain due to exercise number 4 in the exercise programme (n=2)

Patients that experienced moderate adverse events related to the orthoses (n=3):

- Pain, stiffness (n=1)
- Numbness (n=1)
- Discomfort, pain (n=1)

Patients that experienced moderate adverse events related to the exercise programme (n=6):

- Persistent pain due to exercise number 4 (n=1)
- Acute tendonitis (n=1)
- Discontinued exercise 4 due to pain (n=3)
- Discontinued exercise 5 due to pain (n=1)
- Discontinued exercise 2 due to pain (n=1)