ORIGINAL ARTICLE

Does occupational therapy delay or reduce the proportion of patients that receives thumb carpometacarpal joint surgery? A multicentre randomised controlled trial

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ABSTRACT

Objectives To evaluate whether occupational therapy, provided in the period between referral and surgical consultation, might delay or reduce the need of surgery in thumb carpometacarpal joint (CMCJ) osteoarthritis and to explore predictors for CMCJ surgery.

Methods This multicentre randomised controlled trial included patients referred for surgical consultation due to CMCJ osteoarthritis. An occupational therapy group received hand osteoarthritis education, assistive devices, CMCJ orthoses and exercises. A control group received only hand osteoarthritis information. Primary outcome was the proportion of patients that had received CMCJ surgery after 2 years. We examined the primary outcome and predictors for surgery with regression models, and time to surgery with the log-rank test and cox regression analyses.

Results Of 221 patients screened for eligibility, 180 were randomised. Information on the primary outcome was collected from medical records for all included patients. Surgery was performed on 22 patients (24%) that had received occupational therapy and 29 (32%) control patients (OR 0.56, 95% CI 0.26 to 1.21; p=0.14). Median time to surgery was 350 days (IQR 210–540) in the occupational therapy group and 296 days (IQR 188–428) in the control group (p=0.13). Previous non-pharmacological treatment (OR 2.72, 95% CI 1.14 to 6.50) and higher motivation for surgery (OR 1.25, 95% CI 1.09 to 1.43) were significant predictors for CMCJ surgery.

Conclusions Occupational therapy showed a small non-significant tendency to delay and reduce the need for surgery in CMCJ osteoarthritis. Previous non-pharmacological treatment and higher motivation for surgery were significant predictors for surgery.

Key messages

What is already known about this subject?
► The 2018 EULAR recommendations for hand osteoarthritis management state that all patients with hand osteoarthritis should be offered non-pharmacological treatment and that surgery should only be considered when other treatment modalities have not sufficiently relieved pain.
► High-quality studies on non-pharmacological treatment for thumb carpometacarpal osteoarthritis is scarce.

What does this study add?
► In this study patients that had received occupational therapy had a small non-significant delay and reduction in thumb carpometacarpal surgery compared with the patients in the control group that did not receive such treatment.

How might this impact on clinical practice?
► The results of this study may support a notion that all patients with carpometacarpal thumb osteoarthritis should routinely be referred to occupational therapy before surgery is considered.

INTRODUCTION

Hand osteoarthritis (HOA) is a highly prevalent joint disease, ranked as the most common form of osteoarthritis (OA).[1] HOA is often associated with a high clinical burden; it causes persistent pain, increased stiffness, and reduced grip strength, which may significantly limit daily activities related to self-care, work, and leisure, and reduce the quality of life.[2–5] The thumb carpometacarpal joint (CMCJ) is among the most commonly affected hand joints. In the Framingham cohort, symptomatic CMCJ OA was observed in 2% of men and 7% of women aged 40–84 years; while radiographic CMCJ OA was present in 30% of men and 33% of women in the same study.[6]

The 2018 EULAR recommendations for HOA management highlight that all patients

with HOA should be offered patient education, hand exercises and assistive devices. Orthoses should be considered for symptom relief in patients with CMCJ OA. Surgery should only be considered when other treatment modalities have not sufficiently relieved pain.[7] However, the optimal timing for surgical intervention remains unknown.[8] A Cochrane review on CMCJ OA surgery evidence[9] could not demonstrate whether any surgical technique for CMCJ OA conferred benefit over any other techniques, in terms of pain and physical function. However, more complicated surgery interventions were found to increase postoperative complications compared with a simple trapeziectomy.[9–11]

Previous studies have emphasised the importance of implementing the EULAR recommendations into routine clinical practice to further develop, evaluate, and improve the quality of HOA care.[1 12] Occupational therapy (OT) for CMCJ OA reflects the EULAR recommendations for non-pharmacological HOA treatment.[10] A small study by Berggren and colleagues[13] concluded that OT interventions for patients awaiting CMCJ surgery reduced the need for surgery. However, high quality studies are needed to evaluate whether OT can delay or reduce the need for CMCJ surgery and to identify predictors for surgery.

This study aimed to evaluate whether OT, provided in the period between referral and surgical consultation, could delay or reduce the need of surgery in CMCJ OA. A secondary aim was to explore predictors for CMCJ surgery.

METHODS
Study design
This multicentre, randomised controlled trial (RCT) compared an OT group to a control group. The study was conducted at three Norwegian hospitals. Patient recruitments started in April 2013, at St. Olav's University Hospital in Trondheim and Haukeland University Hospital in Bergen, and in May 2014, at Haugesund Rheumatism Hospital in Haugesund. Patients were assessed at baseline (before randomisation) and at 4-month, 18-month and 24-month follow-ups. Patient recruitment was complete by June 2015, and the last follow-up assessment was in June 2017. Study protocol details have been published previously.[14] A patient research partner (ØA) participated in the project group in developing research questions, designing the interventions, and discussing and publishing the results. Written informed consent was obtained prior to baseline assessments and randomisation.

Participants
Potential participants were identified among patients referred by their general practitioner (GP) to surgical consultation due to CMCJ OA. Study coordinators contacted the patients, informed them about the study, and screened them for eligibility. We excluded patients

that did not speak Norwegian or had cognitive dysfunctions.

Intervention
Immediately after randomisation, patients in the occupational therapy group met an experienced occupational therapist for a single session, which initiated a 3-month OT self-management intervention. The intervention was based on international recommendations for non-pharmacological HOA treatment[15] and studies on HOA care[16–20] and comprised the following four elements: oral and written HOA education included in a treatment diary, five assistive devices, day and night CMCJ orthoses, and a hand exercise programme (online supplementary file, Occupational therapy interventions). Two weeks later, they met at the hospital for adjustments of orthoses and exercise programme. The control group received brief oral and written HOA information (page 4 in the Patient education booklet, online supplementary file, Occupational therapy intervention). They also completed a rescoring of the Measure of Activity Performance of the Hand (MAP-Hand) in a telephone interview after 2 weeks for reliability testing purposes. The patients in both groups were allowed to use analgesics (anti-inflammatory and pain relief medication) as usual. All patients that underwent surgery were given postoperative treatment according to the usual procedures, regardless of group allocation. After the 24-month follow-up, the control group was offered the OT self-management intervention.

Intervention adherence
Exercise sessions and the use of day and night orthoses were recorded by the patients in a treatment diary during the 3-month intervention period. The use of assistive devices was reported by patients at each follow-up. Acceptable treatment adherence was defined as fulfilling a minimum of three of the following four treatment elements during the first 3 months: (a) two exercise sessions recorded per week, for at least 8 weeks; (b) use of a day orthosis for at least 4 days per week, for a minimum of 8 weeks, regardless of the number of hours used per day; (c) use of a night orthosis for at least 5 hours per night for a minimum of 5 days a week for at least 8 weeks; and (d) use of at least three of the five assistive devices, reported at the 4-month follow-up.

Adverse events
Single episodes of pain that occurred after 2 weeks of the intervention period related to exercise, and/or discomfort using orthoses were defined as minor adverse events, while persistent pain and/or discomfort were defined as moderate adverse events. Patients reported how problematic they perceived the use of assistive devises on a numeric rating scale (NRS) (0–10, 0=not problematic, 10=very problematic).

Outcome measurements
The primary outcome was the proportion of patients in each group that had received CMCJ surgery after 2 years.

Information on surgery was collected from medical records for all included patients.

The International Classification of Functioning, Disability and Health (ICF) model[21] was used to categorise baseline demographic and clinical characteristics (table 1). Personal factors included age, gender, marital status, work status, level of education, hand dominance, and motivation for surgery (NRS 0–10, 0=no motivation). Disease factors included comorbidities, symptom duration, previous hand surgery, referred hand(s) for surgery, previous non-pharmacological treatment for HOA, and use of analgesics (pain relief and anti-inflammatory medications). Body structures included severity of radiographic CMCJ OA classified using the Modified Kellgren-Lawrence grade (KLG) scale (grades 0–4, 0=no OA)[6]; the absence/presence of clinical CMCJ subluxation, measured with a digital caliper and Osirix software[22]; and the number of interphalangeal joints (IPJs) with clinical nodes (0–9 joints on each hand).[23] Body function was assessed as the number of examined painful metacarpophalangeal joints (MCPJs) and IPJs (0–14 joints on each hand) assessed in a clinical examination, and the fingertip-to-palm-distance test (FPD test[24];) as the total active flexion deficit for each hand, defined as the sum of flexion deficits in the 2nd-5th to fifth fingers, measured as the distance (mm) between the proximal palmar crease to the distal point of each finger. Furthermore, the active range of motion (°) was measured in thumb IPJs and MCPJs with a goniometer, and active CMCJ abduction (°) was measured with the Pollexograph.[25] Pinch and grip strength (Newton) were measured with the Grippit electronic instrument. A standard test procedure was followed and normative measurement data is available.[26] The formula used for the calculation of percentage of normal age- and gender-related pinch/grip strength was $\left(\frac{patients\ pinch\ strength}{normal\ pinch\ strenght} \times 100\right)$ and $\left(\frac{patients\ grip\ strength}{normal\ grip\ strenght} \times 100\right)$. Pain at rest and after grip and pinch strength test were self-reported on a NRS (0–10, 0=no pain). Activity and participation were self-reported with the MAP-Hand (1–4, 1=no activity problems)[27] and the Disabilities of the Arm, Shoulder and Hand questionnaire (QuickDASH; 0–100, 0=no disability).[28]

Sample size

We performed a power calculation, based on the assumptions that at least 70% of the referred patients would undergo surgery and that the number of operations in the OT group would be less than in the control group (one-sided calculation). To detect a difference of 20% between the groups with a power of 80%, a significance level of 0.05, and a 20% drop-out rate, a total of 180 patients (90 in each group) was required.

Randomisation and allocation

A statistician that was not involved in the study made a computer-generated randomisation list with a block size of 10. Concealed, opaque envelopes were used to allocate patients. The envelopes were stored at each hospital and

opened by the patient after undergoing baseline assessments and receiving HOA information.

Blinding

After allocation, the patients and the therapists that delivered the OT interventions were no longer blinded. To blind the surgeons, patients were encouraged not to reveal group affiliations during the surgical consultation; however, the success of this blinding was not assessed. Furthermore, the researcher that performed the main statistical analysis (NØ) was blinded to group allocations.

Statistical methods

The statistical analyses were performed on an intention-to-treat basis. A multilevel analysis showed that the different hospitals only explained 4% of the variance regarding CMCJ surgery; thus, multilevel analyses were not considered necessary. Crude and adjusted logistic regression analyses (results expressed as ORs) were performed to compare the proportions of patients in the two groups that had received CMCJ surgery after 2 years, and to investigate predictors for CMCJ surgery with a predefined set of variables as covariates (table 2). In the latter analysis, variables with a p<0.10 were included in the adjusted model. Correlation analyses were performed to investigate multicollinearity. The time to surgery was examined with a Kaplan-Meier plot. The between-group difference in the time to surgery was assessed with Mann-Whitney U test, mean number of days for survival was analysed using the log-rank test, and the HR for receiving CMCJ surgery after 2 years was assessed in a Cox regression analysis.

We also performed per-protocol analyses excluding OT group patients that did not fulfil the intervention adherence criteria and control group patients who had used assistive devices and/or orthoses during the study period. No missing values were imputed, and no outliers were excluded in the analyses.

RESULTS

Of 221 eligible patients, 180 (81%) agreed to participate (mean age: 63 years, SD 7.6) and 142 (79%) were women. Patients were randomly assigned to the OT group (n=90) or the control group (n=90). The study groups were comparable at baseline, except for the flexion deficit in the second to fifth fingers (p=0.04) (table 1). Eighty-four patients (93%) in the OT group and 83 patients (92%) in the control group completed the 24-month follow-up assessments (online supplementary file, Study flow diagram). There were no missing data on the primary outcome (n=180). The intervention at baseline and follow-up after 2 weeks lasted approximately 90 min for each patient in the OT group.

Of 90 patients in the OT group, 89 (99%) returned their treatment diaries, and 72 (82%) met the criteria for exercise adherence. A mean of 77% (SD 30.2) of the total possible exercise sessions was performed. The criteria for the use of day and night orthoses were met by 61 (68%) and 49 (54%) patients, respectively. The

Table 1 Baseline demographic and clinical characteristics of 180 patients with thumb carpometacarpal osteoarthritis stratified by study groups

	Total (n=180)	Occupational therapy group (n=90)	Control group (n=90)
Personal factors			
Age, years, mean (SD)	63.0 (7.6)	62.8 (7.5)	63.3 (7.8)
Women, n (%)	142 (79)	73 (81)	69 (77)
Living alone, n (%)	35 (19)	17 (19)	18 (20)
Employed, n (%)	91 (51)	48 (53)	43 (48)
Education at university level, n (%)	63 (35)	15 (16)	12 (13)
Hand dominance, right, n (%)	168 (93)	81 (90)	87 (97)
Motivation for CMCJ surgery (0–10, 0=no motivation), median (IQR)	5 (3 to 8)	5 (3 to 8)	5 (3 to 8)
Disease factors			
Comorbidities, yes, n (%)	117 (65)	58 (64)	59 (66)
Symptom duration, years, median (IQR)	5 (2 to 10)	5 (2 to 10)	5 (2 to 10)
Previous hand surgery, yes, n (%)	36 (21)	22 (26)	14 (16)
Referred for hand surgery: in the right hand, n (%)	53 (29)	31 (34)	17 (19)
in the left hand, n (%)	48 (27)	24 (27)	29 (32)
in both hands, n (%)	70 (44)	35 (39)	44 (49)
Previous non-pharmacological treatment, yes, n (%)	37 (21)	16 (19)	21 (25)
Analgesics (anti-inflammatory and pain relief medication), n (%)	114 (63)	57 (63)	57 (63)
Body structures			
Radiographic CMCJ OA severity (grades 0–4, 0=no CMCJ OA), median (IQR)	3 (3 to 4)	3 (3 to 4)	3 (3 to 4)
Presence of clinical CMCJ subluxation, n (%)	113 (68)	58 (72)	55 (65)
Number of finger joints with clinical nodes (0–9 IPJ on each hand), median (IQR)	0 (0 to 0)	0 (0 to 3)	0 (0 to 2)
Body functions			
Painful finger joints (MCPJ, IP, PIPJ, DIPJ: 0–14 joints on each hand), median (IQR)	2 (1 to 5)	3 (1 to 5)	2 (0 to 5)
Flexion deficit second to fifth fingers, mm, median (IQR)	0 (0 to 1)	0 (0 to 4)	0 (0 to 0)
Range of motion thumb IP, degrees, median (IQR)	70 (60 to 78)	70 (59 to 76)	70 (61 to 80)
Range of motion MCP1, degrees, median (IQR)	50 (42 to 58)	50 (40 to 56)	52 (44 to 60)
Abduction CMCJ, degrees, median (IQR)	36 (31 to 43)	36 (30 to 42)	37 (32 to 43)
Pinch strength referred hand, mean (SD)	31.8 (16.8)	30.9 (14.7)	32.8 (18.6)
Grip strength referred hand, mean (SD)	185 (105.0)	177.7 (96.7)	192.3 (112.8)
Pinch strength referred hand (% of normal pinch strength), mean (SD)	61 (24.9)	61 (24.2)	62 (25.7)
Grip strength referred hand (% of normal grip strength), mean (SD)	64 (25.4)	63 (25.5)	66 (25.5)
Pain following measure of pinch strength (0–10, 0=no pain), median (IQR)	4 (2 to 6)	3 (1 to 6)	4 (2 to 5)
Pain following measure of grip strength (0–10, 0=no pain), median (IQR)	3 (2 to 5)	3 (1 to 5)	3 (2 to 5)
Pain at rest (0–10 scale), median (IQR)	3 (1 to 4)	3 (1 to 4)	3 (2 to 5)
Activity and participation			

Table 1 Continued

	Total (n=180)	Occupational therapy group (n=90)	Control group (n=90)
Hand activity performance (1–4, 1=no activity problems), mean (SD)	1.97 (0.42)	1.97 (0.44)	1.97 (0.40)
Disabilities of the arm, shoulder and hand (0–100, 0=no disability), mean (SD)	36.9 (16.5)	35.7 (16.9)	38.0 (16.2)

Numbers are reported as mean and SD, number and proportions (%), or median and IQR. Radiographic carpometacarpal joint osteoarthritis (CMCJ OA) severity is classified using modified Kellgren-Lawrence grade (KLG) scale (grades 0–4, 0=no CMCJ OA). Pain is self-reported using numeric rating scale (NRS 0–10, 0=no pain). Grip and pinch strength is measured in Newton (N) using the Grippit electronic instrument. Range of motion is measured in degrees with goniometer. Palmar abduction thumb and CMCJ abduction is measured in degrees using the Pollexograph. Hand activity performance is measured using MAP-Hand (1–4, 1=no activity problems). Disabilities of the arm, shoulder and hand is measured using QuickDASH (0–100, 0=no disability).
DIPJ, distal interphalangeal joints; IP, thumb interphalangeal joint; IPJ, interphalangeal joints; MCPJ, metacarpophalangeal joint thumb; MCPJ, metacarpophalangeal joints; PIPJ, proximal interphalangeal joints.

average percentage of days using orthoses was 69% (SD 33.1) for day orthosis and 64% (SD 36.7) for night orthosis. Sixty-two (69%) patients reported that they used a minimum three assistive devices. Fifty-eight (64%) patients in the OT group were characterised as having acceptable treatment adherence.

Table 2 Intention-to-treat analyses predicting likelihood for CMCJ surgery; crude analyses and adjusted analysis

	Crude analyses		Adjusted analysis	
	Or (95% CI)	P value	Or (95% CI)	P value
Study group, OT-group	0.68 (0.35 to 1.31)	0.25	0.56 (0.26 to 1.21)	0.14
Age	0.97 (0.93 to 1.01)	1.19	0.97 (0.92 to 1.02)	0.21
Gender, females	1.35 (0.59 to 3.10)	0.48	1.08 (0.38 to 3.06)	0.88
Previous hand surgery, yes	0.94 (0.41 to 2.13)	0.88		
Previous non-pharmacological treatment, yes	2.77 (1.29 to 5.93)	0.009	2.72 (1.14 to 6.50)	0.024
Motivation for surgery (0–10, 0=no motivation)	1.26 (1.12 to 1.41)	<0.001	1.25 (1.09 to 1.43)	0.001
Radiographic CMCJ OA severity: grade 0–1 (grade 0=no CMCJ OA)	1			
grade 2	2.29 (0.55 to 9.52)	0.26		
grade 3	1.87 (0.56 to 6.20)	0.31		
grade 4	1.56 (0.46 to 5.27)	0.47		
Presence of clinical CMCJ subluxation, yes	0.91 (0.45 to 1.87)	0.80		
Painful joints (MCPJ, IP, PIPJ, DIPJ: 0–14 joints)	1.11 (0.99 to 1.24)	0.070	1.10 (0.95 to 1.27)	0.22
Flexion deficit second to fifth fingers, mm	0.99 (0.98 to 1.01)	0.39		
Abduction CMCJ, degrees	0.96 (0.93 to 1.00)	0.059	0.97 (0.93 to 1.02)	0.20
Grip strength referred hand (% of normal grip strength)	0.99 (0.98 to 1.00)	0.090	1.00 (0.98 to 1.02)	0.90
Pain following measure of grip strength (0–10, 0=no pain)	1.15 (1.00 to 1.32)	0.051	1.05 (0.89 to 1.23)	0.59
Hand activity performance (1–4, 1=no activity problems)	1.45 (0.67 to 3.12)	0.35		
Disabilities of the arm, shoulder and hand (0–100, 0=no disability)	1.02 (1.00 to 1.04)	0.060	1.00 (0.97 to 1.02)	0.81

Motivation for surgery is self-reported using numeric rating scale (NRS 0–10, 0=no motivation). Radiographic carpometacarpal joint osteoarthritis (CMCJ OA) severity is classified using modified Kellgren-Lawrence grade (KLG) scale (grades 0–4, 0=no CMCJ OA). Pain is self-reported using numeric rating scale (NRS 0–10, 0=no pain). Grip strength is measured in Newton (N) using the Grippit electronic instrument. Abduction CMCJ is measured in degrees using the Pollexograph. Flexion deficit is measured in millimetres. Activity performance is measured with mean score of MAP-Hand (1–4, 1= no activity problems). Disabilities of the arm, shoulder and hand is measured using sum score of QuickDASH (0–100, 0=no disability).
DIPJ, distal interphalangeal joints; IP, thumb interphalangeal joint; MCPJ, metacarpophalangeal joint; PIPJ, proximal interphalangeal joints.
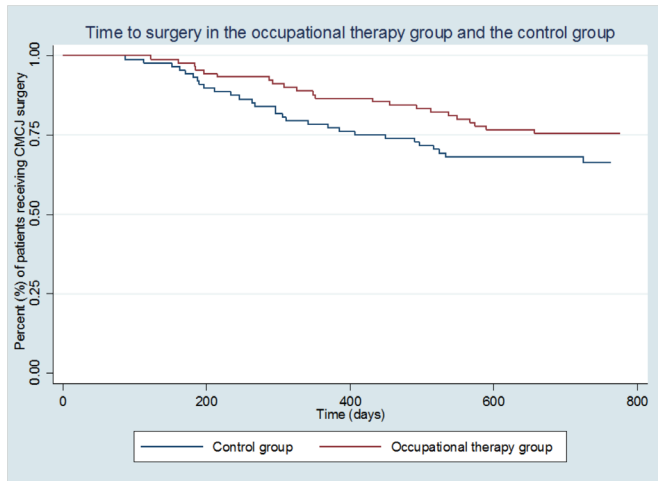
Figure 1 Kaplan-Meier plot of time to surgery in days for patients the occupational therapy group and the control group. For non-operated; time was set to 730 days (2 years) follow-up. CMCJ, thumb carpometacarpal joint.

Of the 180 patients, 22 (24%) patients in the occupational therapy group and 29 (32%) in the control group underwent surgery before the 24-month follow-up. The odds for undergoing surgery were lower for the OT group than the control group (OR_{crude}: 0.68 (95% CI 0.35 to 1.31; p=0.25 and $OR_{adjusted}$: 0.56, 95% CI 0.26 to 1.21; p=0.14) but did not reach statistical significance. The median days to surgery were 350 (IQR 210–540) and 296 (IQR 188–428) in the OT and control groups, respectively (figure 1). The log-rank test showed a small non-significant difference in mean survival period between the two groups (644 days in the OT group and 597 days in the control group, p=0.16). The HR for receiving CMCJ surgery after 2 years was 0.68 (95% CI 0.39 to 1.17, p=0.16) for the OT group compared with the control group.

Crude and adjusted regression models (table 2) showed that previous non-pharmacological treatment (OR 2.72, 95% CI 1.14 to 6.50) and high motivation for surgery (OR 1.25, 95% CI 1.09 to 1.43) were significantly associated with CMCJ surgery (p<0.05).

Per protocol analyses were performed with 138 patients, after excluding 32 patients in the OT group due to non-adherence to the interventions and ten control group patients who had received assistive devices and/or orthoses. The odds for undergoing surgery in the OT group compared with the control group remained non-significant as in the ITT analysis ($OR_{adjusted}$ 0.65, 95% CI 0.26 to 1.58). Previous non-pharmacological treatment (OR 4.04, 95% CI 1.44 to 11.37) and motivation for surgery (OR 1.27, 95% CI 1.08 to 1.49) remained significant predictors for surgery. During the intervention period, 17 patients (19%) experienced minor or moderate pain or discomfort with the orthoses and/or hand exercises (online supplementary file, Adverse events). Few problems were reported for using the assistive devices (median score 0, IQR 0–2).

DISCUSSION

To our knowledge, this is the first high-quality RCT to investigate whether OT provided in the period between a referral and a surgical consultation could delay or reduce the need of surgery due to CMCJ OA. Although not significant, the results show a small tendency towards both a reduction and a delay in CMCJ surgery among patients that received OT. We identified two significant predictors for surgery: undergoing non-pharmacological treatment before a referral to surgical consultation and high motivation for surgery.

In this study, the multimodal OT treatment was based on recommendations from recent reviews and meta-analyses on general OA-care[29 30] and, specifically, on CMCJ OA care.[31–33] The OT treatment was consistent with the 2018 EULAR recommendations for HOA management.[10] Although our results showed a reduced surgery rate in the OT group, more knowledge is required regarding which components or which combinations and dosages of components would be optimal in non-pharmacological treatment for CMCJ OA.

Consistent with previous studies, we found that fewer patients in the OT group underwent surgery compared with the control group. In a study by Berggren *et al*,[13] 70% of patients awaiting CMCJ surgery no longer needed surgery after performing OT. In a recent study,[34] only 15% of patients scheduled for CMCJ OA surgery underwent surgery after receiving hand therapy and orthoses, and in a study among 224 patients referred to a hand surgeon for common hand conditions, such as CMCJ OA, OT management was the only significant predictor of a reduced rate of surgical treatment.[35] However, none of these previous studies included a control group. Therefore, RCTs are warranted to explore the effect of OT, including trials with head-to-head comparisons of OT and surgery for CMCJ OA.

The OT intervention at baseline and follow-up after 2 weeks lasted approximately a total of 90 min per patient and included assessments, patient education, guidance and adjustment of the hand exercise programme, and customisation and adjustments of orthoses. Whether a cost-effectiveness of OT can justify a reduction in surgery rate will be examined in a substudy.

When planning our study, we could not identify studies that reported the number of referrals that led to surgery. Therefore, the 70% surgery rate used in the sample size calculation was based on surgeon assumptions, rather than facts. The results in our study showed that a much lower proportion had received surgery after 2 years (28%). Thus, even with a lower dropout rate than expected, the study was probably underpowered for detecting the suggested 20% difference between groups with the assigned power and significance levels. Hopefully, these results can be used to ensure a more realistic power calculation in future studies.

The main indication of CMCJ surgery is to reduce pain and improve function.[9] Unlike other studies,[34 36] we found that these variables were not significant predictors

of surgery; in contrast, we identified previous received non-pharmacological treatment and high motivation for surgery as significant predictors. Unfortunately, we do not have information on the success of non-pharmacological treatment in patients with CMCJ OA in general. Nevertheless, it is unlikely that such treatment would sufficiently relieve pain and functional limitations in all patients. Thus, patients with most severe CMCJ OA are likely to revisit their GP, who, consistent with treatment recommendations,[7] may refer them to surgical consultation. Our finding that previous non-pharmacological treatment and motivation for surgery significantly predict surgery indicates that these parameters should be routinely examined in GP consultations. Patient choices should be based on realistic information about possible treatment outcomes, discussed in close dialogue with healthcare professionals.

To facilitate the translation of evidence-based HOA recommendations into practice, several models have been developed for the delivery of HOA care.[37] One model is a clinical algorithm that provide a stepwise approach for delivering non-pharmacological and pharmacological therapies.[38] Another model is a UK programme that comprise a consultation with a GP, followed by up to four sessions with a nurse that focus on self-management.[39] A third model is a Swedish programme, which promote better management of patients with OA delivered by physiotherapists, occupational therapists, and expert patients.[40] It has been suggested that occupational therapists should play a crucial role in the management of patients with HOA[41] because they are trained in client-centred, biopsychosocial, and motivational approaches, including the assessment and treatment of body functions, activity limitations and participation restrictions. This view is supported by results from a recent ethnographic study on OT hand clinics, where the therapists' perspectives on assessing and addressing activity and participation were perceived as an important bonus to traditional biomedical understanding.[42] However, more research is needed to develop a timely, cost-effective protocol that describes how, when, and by whom specific therapies should be provided to individuals with CMCJ OA.

This study had several strengths. It had a low dropout rate, a large proportion of patients with high treatment adherence, and no serious adverse events; which indicates that OT was safe and feasible for most patients. Furthermore, involving a patient research partner in all stages of the study helped to ensure a patient-friendly design and a nuanced interpretation of the results. Inclusion of patients from the three different hospitals enhanced the generalisability of the results.

Our study also had some limitations. We could not design a placebo-controlled or blinded trial, due to the lack of convincing placebos or sham OT programmes; moreover, the therapists delivering the intervention could not be blinded. However, patients were instructed not to disclose their group allocation to the surgeon at the consultation. Additionally, information on the primary outcome (received surgery) was an objective outcome obtained from patient medical records. Furthermore, secondary outcomes were from either patient self-reported measures or standardised instruments, which reduced the chance that results might be greatly affected by observer bias. It would also have been interesting to explore if surgeons' willingness to operate had any influence on the surgery rate. However, the study was not powered for such analyses.

In conclusion, we found a small non-significant tendency towards a delay and reduction in CMCJ surgery in patients that received OT, compared with a control group. Previous non-pharmacological treatment and motivation for surgery were significant predictors of surgery. These results may support a notion that patients with CMCJ OA should be referred to occupational therapy before surgery is considered.

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Disclaimer A patient research partner (ØA) was involved in all stages of the study. She participated in the project group in developing research questions, designing the interventions, and discussing and publishing the results.

Competing interests None declared.

Patient consent for publication Not required.

Ethics approval The Regional Committees for Medical Research Ethics approved the study. Ref. no: 2012/2265/REK South East Norway. Written informed consent was obtained from all participants included in the study.

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