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A systematic review of the benefits of occupation-based intervention for patients with upper extremity musculoskeletal disorders

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ABSTRACT

Study Design: Systematic review of intervention studies (level 3a).
Introduction: Occupation-based intervention (OBI) uses daily activities as a treatment modality. Its growing use with patients diagnosed with upper extremity musculoskeletal disorders (UE MSK) has driven interest in its supporting body of evidence.
Purpose of the Study: The purpose of this study was to locate, appraise, and summarize current evidence of the effectiveness of OBI in treating patients with UE MSK.
Methods: Searches of PubMed, CINAHL, the Cochrane Register for Controlled Trials, and PEDro databases were conducted using predetermined keywords. Studies included in this systematic review described the use of OBI in UE MSK. Two examiners independently reviewed and assessed the quality of each study using the PEDro scale.
Results: Results of the database searches yielded 991 studies, 13 of which were deemed eligible to include in this review (6 randomized controlled trials, 4 pretreatment/post-treatment cohort or case series studies, and 3 single case reports). Quality of the studies varied, with 4 rated poor, 2 moderate, and 4 excellent. Overall, individuals receiving OBI showed superior benefits in patient-reported, performance, and physical measures assessing the upper extremity.
Discussion: Findings of this review provide preliminary evidence for the use of OBI with patients with UE MSK, however, generalizability of the evidence was compromised due to heterogeneity in study subjects as well as conceptualization, dosage, and delivery of OBI.
Conclusions: The existing literature reflects promising trends in the use of OBI, underscoring its utility as a treatment option for UE MSK-related impairment, limitations, and restrictions. Nonetheless, scientific evidence concerning the effectiveness of OBI needs to be improved by conducting high-quality studies that clearly conceptualize this intervention and heighten understanding of its role in hand therapy practice.

Introduction

Occupation-based intervention (OBI) is gaining traction in the hand therapy literature. Occupations, defined as the "daily life activities in which people engage … hav[ing] purpose, meaning, and perceived utility to the client …"[a] (American Occupational Therapy Association, p. S6, 2014),[1] is a longstanding cornerstone in the philosophy and practice of occupational therapy. Although successful resumption of daily activity, whether stated or implied, has always been the ultimate goal of hand therapy, the use of daily activity as a treatment intervention has more recently become the subject of research. This has been especially noticeable in the past 10-20 years. The term occupation-based intervention refers to a therapist's use of "engagement in occupation as the therapeutic agent of change" (p. 98).[2]

Therapists report several benefits of using OBI with patients with upper extremity musculoskeletal disorders (UE MSK). Among the unique advantages of OBI is that it capitalizes on the familiarity

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[a] A more complete definition can be found in the *Occupational therapy practice framework: domain and process, 3rd edition*, 2014, pages S5-S7.[1]

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of everyday tasks, using automatic movements involving the body in a different manner than rote exercise.[3] Participation in a functional activity can also be engaging, distracting the patient from discomfort or anxiety when moving an injured upper extremity. Use of OBI can avert a learned disuse of the upper extremity[4] and be meaningful and productive, with relevance to a patient's specific goals.[3]

Details as to what is considered OBI vary. Some mandate that OBI not only comprise evaluation and treatment but also do so in a natural context, providing the patient with pleasure and a sense of accomplishment.[2] Others advocate self-direction and the use of meaningful life activities as components of OBI.[5] The approach of still others is to balance OBI with the biomechanical needs of the UE MSK population.[6] Although occupation has been the philosophical cornerstone and conceptual foundation of occupational therapy since its inception,[2] and OBI, as a treatment intervention, is an outgrowth of that foundation, a larger shift, signaled by the publication of International Classification of Functioning, Disability and Health (ICF) by the World Health Organization in 2001, mandates that conceptualizations of health include a person's ability to function in all aspects of life.[7] The ICF terms *activity* and *participation* are defined respectively as "the execution of a task or action by an individual" and "involvement in a life situation" (p. 10).[7] Occupational and physical therapists are beholden to their individual domains of concern, in addition to the larger interdisciplinary ICF framework. Using OBI as a treatment modality can facilitate the ability of both occupational and physical therapists to addressing patients' activities and participation. For the purposes of this study, we operationally define OBI as the use of simulated or actual life tasks as an intervention.

Research regarding the efficacy of OBI in the UE MSK population is growing, but an overview of the current level of evidence is needed. Several case reports/series highlight an OBI approach,[4,8-13] and a number of randomized controlled trials (RCTs)[14-19] incorporate OBI. Recent systematic reviews, however, focus on occupational therapy interventions overall, which can include a wide range of treatment, including preparatory methods, stretching, and exercise in addition to purposeful activity or OBI.[20-22]

Although there is agreement that therapists *think* occupation is a beneficial medium for treating patients with UE MSK, according to a 2010 survey, one of the stated impediments to the use of OBI is its credibility as an intervention.[3,23] To address the knowledge gap, this systematic review located, appraised, and summarized the literature assessing the benefits of OBI in hand therapy practice.

Methods

This review adopted the methodology recommended by the *Cochrane Handbook for Systematic Reviews of Intervention Studies*.[24] Consistent with this approach, the following steps were undertaken in a sequential manner.

Eligibility criteria

Primary studies that were parallel-group RCTs, prospective or retrospective cohort studies, case series, or case reports in which the effectiveness of OBI in patients with UE MSK was evaluated, as well as any studies in which interventions included actual functional task performance, purposeful activity, or daily activity as part of therapy were deemed eligible for this review. Studies that included discussion of activities in lieu of functional performance, worksite modification/ergonomic intervention, exercise as the intervention, or patients with neurologic upper extremity injuries/difficulties were excluded, as were systematic reviews. All outcome measures were considered for this review, including patient-reported outcomes (PROs), performance and physical measures, and disease-specific assessments.

Search techniques for identifying relevant studies

Four databases, PubMed, CINAHL, the Cochrane Register for Controlled Trials, and PEDro, were searched to identify relevant studies in the area. The keywords used for each of the databases and the search results are shown in Table 1. The search terms were developed a priori by the coauthors (GW-Z and SPM). Finally, hand searching of reference lists of the studies deemed to be eligible for this review and the related article feature available in PubMed were used to locate relevant studies.

Data collection and analysis

Selection of studies

The citations obtained from the search process were initially scanned to locate and remove duplicates. Those remaining were subjected to the eligibility criteria and underwent a sequential process to derive the list of studies relevant for the purposes of this review. Both the titles and abstracts of the studies' citations were examined to determine their eligibility, and those that were not relevant were removed. After this, GW-Z and SPM independently read the full text of the remaining articles and deliberated on their relevance for this review. Disagreements were resolved by discussion, and a consensus was reached in each case, the agreement assessed by examining weighted kappa (κ), where κ values of $\geq$0.7 were considered as having substantial agreement.[25]

Data extraction and management

Because single extraction is known to result in errors and lack comprehensiveness,[26] the data extraction from the included studies was done by GW-Z and checked by SPM to ensure accuracy. The details for the treatment and control interventions, as well as cointerventions, were retrieved. The descriptive information for the patient population was extracted, outcomes collected, and results of the interventions drawn from each study.

Assessment of risk of bias

The risk of bias in the included studies was assessed using the PEDro scale.[27] The PEDro scale examines methodological quality of the intervention studies, using an 11-item checklist. A score of 1 was assigned when the criteria were met, and a score of 0 if the criteria were not met. The total score for each study was derived by

Table 1
Keywords used for database searches

Keywords
Search terms used for treatment of interest (ie, occupation-based interventions)
Occupation-based interventions
Occupations
Occupational interventions
Occupation centered
Activity focused
Functional interventions
Function-based interventions
Search terms used for injury group of interest (ie, upper extremity musculoskeletal injuries)
Upper extremity injur*
Upper extremity trauma
Upper extremity dysfun*
Arm injur*
Elbow injur*
Wrist injur*
Hand trauma

adding the scores for items 2-11, with 10/10 indicating perfect quality. Studies were rated excellent, if the quality rating was 9/10; good, if the rating was between 7 and 9; moderate, if it was ≥4 but <7; and poor, if the rating was <4. Although the PEDro scale was initially designed and is known to be reliable for assessing quality of RCT,[28] it has also been used for assessing the quality of non-randomized studies.[29]

Assessing the effect of OBI interventions of treatment effect

Given the broader conceptual definition of OBI and interventions we deemed eligible for this review, we expected significant heterogeneity in the components of treatment, dosage, and context in which they are delivered. Moreover, we included any diagnoses that resulted in UE MSK, which we expected would further increase the heterogeneity of the studies. As a result, we were not able to pursue meta-analysis of the outcomes data retrieved, and a narrative summary was provided describing the overall effect of OBI on each outcome (ie, range of motion [ROM], grip strength, pain, and PRO).

Results

A total of 991 citations were located across 4 databases searched using the search terms shown in Table 1. An additional 9 potentially relevant citations were located as a result of a hand search of the professional rehabilitation and hand therapy journals. Of these, 15 were duplicate citations and therefore excluded. After the review of titles and abstracts of the remaining citations, 951 studies were found to be not relevant for this study. This resulted in 34 citations that met the inclusion/exclusion criteria and were therefore selected for full-text review. After full-text review, 13 of these[4,8-19] were selected for inclusion. The flow diagram shown in Figure 1 summarizes the sequential process for literature search and identification of included studies. The raw agreement between the 2 reviewers in identifying studies for inclusion was 90.6, and the weighted κ was 0.85 (95% confidence interval, 0.72-0.97), suggesting substantial agreement.

Description of included studies

Of the 13 studies selected in this review, 6 were RCTs[14-19]; 4 pretreatment and post-treatment cohort or case series studies,[8-11] and 3 single case reports.[4,12,13] A detailed description of these studies, with emphasis on the characteristics of participants, types of interventions provided, outcomes assessed, and the results of the interventions, is provided in Table 2.

Variants of OBI included job tasks (work simulations and typing among other tasks)[8]; writing (for a cohort with writer's cramp)[9,11]; a choice of purposeful activities/play tasks[17]; origami[19]; 3 functional tasks, picking up every day small objects, typing on a keyboard, wiping/washing dishes[14]; 25 daily tasks[15]; activity-focused therapy[16]; functional hand use during modified occupation-based constraint-induced motor therapy (O-CIMT)[10,18]; and occupations from the patients' daily lives.[4,12,13]

Dosage for OBI ranged from 2 to 10 weeks,[4,8-19] with sessions lasting anywhere from 30 minutes to 3 hours. Two studies provided the average 4.4 sessions[16] and 6 sessions.[11] The remaining total number of sessions as specified ranged from 6 to 16 sessions, for a total of 6-20 hours.[4,9,10,12-15,19] Given the information provided, it was difficult to calculate the total number of hours or sessions of OBI in 4 of the studies.[4,8,17,18] Dosing, of 20 hours or more of OBI, was reported in the 2 studies using modified CIMT.[10,18] The 2 studies addressing writer's cramp had similar dosing, with 6-7 sessions on average.[9,11] Two of the 3 case reports reviewed initially

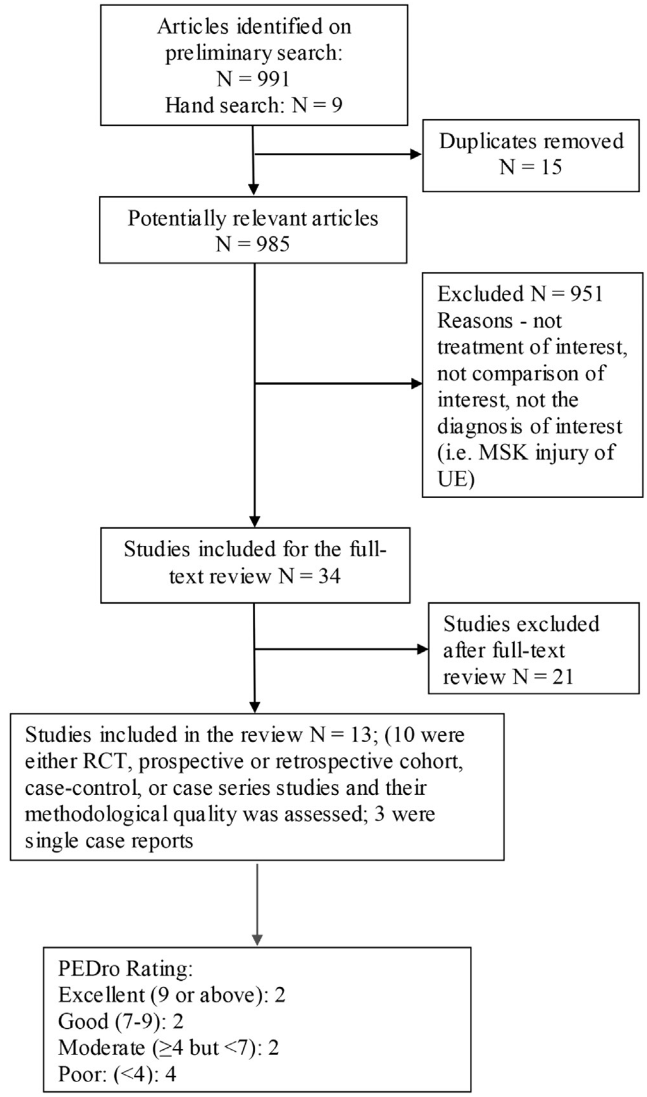

Fig. 1. Flow diagram for search process and identification of studies for this review. *From*: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. *P*referred *R*eporting *I*tems for *S*ystematic Reviews and *M*eta-*A*nalyses: The PRISMA Statement. PLoS Med. 2009;6(7):e1000097.

used a biomechanical approach for 10[12] to 17[13] weeks before shifting to OBI.

Outcome measures used to assess the benefits of OBI varied across the studies. PRO measures that captured functional performance included the Canadian Occupational Performance Measure (COPM),[12,14,18] Disabilities of the Arm, Shoulder and Hand (DASH),[10,14,15,18] and patient-rated wrist evaluation (PRWE).[16] The self-assessment manikin scale was used in 1 study[18] to measure emotional responses in a situation, particularly in the pleasure, arousal, and dominance dimensions. Performance measures were incorporated into 6 studies, 2 using the box and block test,[10,18] 3 using the Jebsen-Taylor hand function test (JTHFT),[15,17,19] and 1 using the Purdue pegboard test.[14] The 2 studies that assessed improvement in writing as a result of OBI used specific metrics for writing as the primary outcome.[9,11] One study created a metric for return to work,[8] and the remaining studies used physical measures, such as grip strength, pinch strength, ROM, Semmes-Weinstein monofilaments, and/or static 2-point discrimination as outcomes.[4,9,10,13-18]

Table 2
Description of studies

Study	Method	Participants	Interventions	Outcomes	Results
Barthel et al, 1998[8]	Retrospective case series	24 patients (12 women and 12 men; mean age not provided) at UCLA rheumatology and hand rehabilitation outpatient clinic with complaints of hand, wrist, or forearm pain	About 22 of 24 received OT as one of several interventions with this multidisciplinary treatment approach. Elements of occupational therapy that were OBI included graded program for individual job tasks (ie, typing for periods that were gradually increased; activity modification for daily activities and leisure tasks) There were significant variations, however, in the treatment dosage, frequency of in-clinic treatment, and the total duration for with patient was under care of OT *Cointervention*: Pharmacologic intervention, psychological pain evaluation, biofeedback	Physician and occupational therapist rated patients on an outcome scaled I, II, and III (scaling categories provided later); treatment outcomes were examined by assessing proportion of patients in these categories after treatment interventions I: Minimal or no improvement, no resumption of work if receiving medical disability compensation II: Moderate improvement in symptoms, often with major workplace modifications or reduction of offending activity; return to work if receiving medical disability compensation III: Improvement in most symptoms, return to same work if receiving medical disability compensation	At the end of the study, the proportions of patients experiencing minimal (scale I) to marked improvement (scale III) was as follows: I: 21% II: 54% III: 25%
Baur, 2009[9]	Single group, prepost test design	7 right-handed patients (4 women and 3 men; mean age, 54.3 ± 8.3 y) with WC (3 simple WC, 4 dystonic WC)	A total of 7 handwriting training sessions were provided according to Mai principles, individualized motor training program to the patient's specific writing disorder, elements of writing/writing conditions were modified and varied to reduce dystonic symptoms, writing with grip force auditory feedback	Following outcomes were assessed before the initiation of treatment program and at discharge; Wilcoxon tests assessed whether the treatment effect was significant or not ($P \leq .05$) • Grip force (Newton [N]) • Writing pressure (N) • Writing frequency (mean strokes per second, recorded in hertz) • NIV • VAS for pain and writing performance • Fahn Dystonia Scale (0-100, the lower the score, the more severe the problems)	Although precise statistical data were not provided, significant improvements ($P < .05$) were reported in writing pressure, grip pressure, and VAS for pain and writing performance The effect sizes for intervention were calculated for writing pressure and grip force, and they were very high (2.81) and moderate (0.57), respectively[30]
Che Daud et al[14]	RCT	About 46 patients from the hand outpatient OT clinic with bone, tendon or PNI to wrists, hand, or forearm; of these, only 40 completed the trial (11 women and 29 men; mean age, 36.2 ± 11.1 y)	*Supervised hand therapy*: 6 wk *Experimental group*: TE + OBI *Control group*: TE After 6 wk of in-clinic therapy, participants continued TE taught to them in clinic at home for additional 4 wk	After outcomes were assessed at baseline, after 6 wk of supervised therapy, and finally after the additional 4 wk of home program *Primary outcome measure*: DASH symptom and disability *Secondary outcomes*: • Purdue pegboard • TAM (derived by subtracting the sum of all extension ROM for all digits from the sum of all flexion ROM of digits) • Grip strength • Pinch strength • Pain measured by the graphic numerical rating scale • COPM • DASH	Significant differences ($P < .05$) were observed in the following after 6 wk of TE + OBI vs only TE and also follow-up assessment at 4 wk after that *TAM*: 1167.4 ± 153.59 vs 1060.75 ± 162.77 at 6 wk and 1203.65 ± 133.6 vs 1035.85 ± 179.84 after another 4 wk *Pain*: 1.4 ± 1.79 vs 3.85 ± 1.98 at 6 wk; and 1.05 ± 2.01 vs 2.9 ± 2.79 after another 4 wk *COPM—performance*: 8.75 ± 1.13 vs 7.56 ± 1.96 at 6 wk and 9.53 ± 0.64 vs 7.62 ± 2.09 after another 4 wk *COPM—satisfaction*: 8.55 ± 1.23 vs 7.44 ± 2.09 at 6 wk and 9.49 ± 0.76 vs 7.6 ± 2.11 after another 4 wk *DASH*: 17.23 ± 13.28 vs 21.06 ± 12.58 at 6 wk and 9.5 ± 9.14 vs 18.64 ± 14.84 after another 4 wk

Guzelkucuk et al, 2007[15]	RCT	36 consecutive patients (proportion for gender not provided; mean age, 23 ± 3 y) with bone, tendon, or PNI that sought treatment within 1.5-6 mo of injury	*Intervention group*: Rehabilitation program included passive, active-assisted, and active ROM and strengthening exercises designed to increase ROM of affected joints plus therapeutic activities that simulated ADL 30-min session of therapeutic activities that simulated ADLs *Control group*: Rehabilitation program consistent with the one mentioned previously minus therapeutic activities Sessions were 5 d a week for 3 wk	Measurements were taken at baseline, after 3 wk of interventions, and 2 mo after the interventions were concluded • Grip strength (kg) • Pinch strength (kg) • TAM of hand (derived by subtracting the sum of all extension ROM for all digits from the sum of all flexion ROM of digits with wrist in neutral position) • ROM of opposition • ROM of abduction (calculated as the sum of the distances between the pulps of the fingers except the first finger) • FP-DPC (distance between distal palmar crease and 3rd digit pulp or average distance of all finger pulps if finger ROM differs • JTHFT • DASH	Significant improvements ($P < .05$) were reported in the intervention group for *DASH*: 37 ± 21 vs 62 ± 17 at 2 wk and 35 ± 17 vs 61 ± 18 after another 2 mo *Grip strength*: 13 ± 6 vs 10 ± 9 kg at 2 wk and 23 ± 14 vs 11 ± 10 kg after another 2 mo *Pinch strength*: 5 ± 2 vs 3 ± 1 kg at 2 wk and 7 ± 3 vs 3 ± 1 kg after another 2 mo *JTHFT*: 4 to 13 ± 1 to 9 vs 5 to 20 ± 1 to 10 at 2 wk and 4 to 18 ± 0.9 to 9 vs 3 to 9 ± 0.8 to 5 after another 2 mo
Maciel et al, 2005[16]	RCT	About 41 patients (19 women and 4 men, mean age, 55.7 ± 17.7 y for physiotherapy group and 12 women and 6 men, mean age 55.8 ± 19.4 y for control group) with distal radius fractures managed conservatively were recruited; of which 35 patients completed the study	*Intervention group*: Routine physiotherapy exercises to restore wrist ROM plus activity-focused treatment approach that was aimed at regaining motor performance, specific components were task-specific training, feedback, practice, and modification of task environment *Control group*: Routine physiotherapy exercises for increasing wrist ROM only with a follow-up a week later to review the exercises with a physiotherapist	Measurements taken at baseline, 6 wk, and 24 wk after cast removal • PRWE • Wrist flexion/extension ROM • Grip strength (kg)	The outcomes were similar ($P > .05$) across the intervention vs the control groups *PRWE* 26.9 ± 24 vs 28.2 ± 20.6 at 6 wk and 21.4 ± 24.5 vs 24.8 ± 22.2 at 24 wk after removal of cast *Grip strength* 15.5 ± 11.6 vs 14.8 ± 8.1 kg at 6 wk and 19 ± 14 vs 20.8 ± 11.1 kg at 24 wk after removal of cast *Wrist flexion*: 42.7 ± 13.7 vs 46.9 ± 9.3 at 6 wk and 50.7 ± 15.6 vs 51.3 ± 11.6 at 24 wk after removal of cast *Wrist extension*: 48.9 ± 15.9 vs 51.6 ± 16.5 at 6 wk and 56.7 ± 16.5 vs 54.3 ± 14.4 at 24 wk after removal of cast
Omar et al, 2012[17]	RCT	30 children (5 girls and 10 boys, mean age, 12.1 ± 1.3 y, for purposeful activity group and 6 girls and 9 boys, mean age, 12.4 ± 1.4 y, for rote exercises group) with superficial partial thickness, deep partial thickness, and full thickness burns, including the hand/wrist but less than 25% TBSA	*Intervention group*: Purposeful activities included playing games that the child enjoyed the most; different choices for games were offered to child before therapy session, which mainly depended on availability of games and the success with the activity during the prior therapy session *Control group*: Rote exercise that included active and active-assisted wrist/hand ROM exercises	Measurements taken at 72 h after burn, at 1, 2, and 3 wk after that, and finally at discharge • Self-report faces scale (pain) • VAS (pain) Measurement taken at 72 h after burn, 3 wk, and discharge • TAM (derived by subtracting the sum of all extension ROM for all digits from the sum of all flexion ROM of digits with wrist in neutral position) Measurement taken at discharge and 3-mo follow-up: • JTHFT	The interventions group experienced significant improvements vs control group in pain, TAM, and JTHFT at 72 h and third week after sustaining burns as well as at discharge from care and 3-month follow-up *Pain*: 4.05 ± 1.02 vs 6.85 ± 2.12 at 72 h; 2.15 ± 1.46 vs 1.9 ± 1.62 at 3 wk; and 1.9 ± 1.62 vs 3.23 ± 2.38 at discharge *TAM*: ROM provided for different thickness across both the groups for all the occasions; in summary, the intervention groups had consistently higher TAM compared with the control group *JTHFT*: (average time taken to complete) 145 vs 185 s at discharge; and 92 vs 126 s at 3-mo follow-up

(*continued on next page*)

Table 2 (*continued*)

Study	Method	Participants	Interventions	Outcomes	Results
Rostam et al[18]	Single subject experimental design, A1-B-A2 design	3 patients (1 women aged 32 y; 2 men aged 25 and 29 y, respectively) with a history of median and ulnar nerve injuries	Modified constraint-induced movement therapy (5× wk for 4 wk, 1 h each session) *Cointervention*: Patients continued with their regular therapy program throughout the study	Following outcomes were assessed in a random order 6 times during the baseline phase (A1), 4 times during the intervention phase (B), and 4 times during the withdrawal phase (A2) • Box and block test • Semmes Weinstein • DASH	Significant improvements were noted in all the 3 patients for scores for the box and block test and the DASH scores after the intervention *Box and block test* group statistics were not provided, the change in the box and block test scores for each patient exceeded the minimal detectable change (5.5 points) *DASH* group statistics were not provided, the change in the DASH scores for each patient exceeded the clinically important difference (20 points)
Rostami et al[18]	Single-blinded RCT	36 participants, 12 in each of the 3 groups: O-CIMT (4 women and 8 men aged 31 ± 8 y), R-CIMT (3 women and 9 men aged 39 ± 10 y), or control group (2 women and 8 men aged 34 ± 6 y); of which 12 each in both the CIMT groups and 10 in control group completed the final assessments	*O-CIMT*: Constraint-induced therapy for 6 h/d for 4 wk, with 3 h of intensive hand training using occupations on even days of the week *R-CIMT*: Constraint-induced therapy for 6 h/d for 4 wk, with 3 h of rote exercise on even days of the week *Control group*: Participants use affected hand in different activities for 1.5 h each day for 4 wk without restrictions on the unaffected hand	Measured at pretest, post-test (end of 4 wk of intervention), and 1-mo follow-up (1 mo after intervention completion) • COPM • Static 2-point discrimination • DASH • Box and block test • Self-assessment manikin scale	All the outcomes improved significantly ($P < .05$) in both the CIMT groups when compared with the control group at 1 mo after interventions were completed *COPM—performance*: O-CIMT 7.2 (6.6-7.7) and R-CIMT 4.9 (4.4-5.5) vs control 3.6 (3.0-4.2) at 1 mo after interventions *COPM—satisfaction*: O-CIMT 6.9 (6.5-7.3) and R-CIMT 4.5 (4.1-4.9) vs control 3.2 (2.7-3.7) at 1 mo after interventions *DASH*: O-CIMT 19.6 (15.8-23.3) and R-CIMT 37.4 (33.6-41.2) vs control 53.9 (49.8-58) at 1 mo after interventions *Static 2-point discrimination*: O-CIMT 5.9 (5.0-6.8) and R-CIMT 9.3 (8.4-10.2) vs control 13.0 (12.0-14.0) at 1 mo after interventions *Box and block test*: O-CIMT 10.1 (9.2-11.0) and R-CIMT 5.2 (4.2-6.1) vs control 3.2 (2.2-4.2) at 1 mo after interventions
Schenk et al., 2004[11]	Case series	50 patients with WC (29 women, 21 men; aged: 44.3 ± 11.0 y) were enrolled, of which only 21 were available for follow-up assessment 21 healthy volunteers were used as a control	Intervention consisted of writing and elements of writing *First training period*: Aimed at identifying and addressing specific problems of the patient, sessions lasted for 50-60 min, 1× wk *Second training period*: Aimed at stabilizing newly acquired writing techniques with sessions once every 2-4 wk	Subjects were asked to repeatedly write 2 interconnected “I’s” in 10 s with movements registered on a digitized tablet. No standardized measures were used, but the outcomes considered specifically for the study were as follows: • Number of letters produced in 10 s • Average peak velocity per stroke • Average number of inversions in velocity per stroke These measurements were taken pretraining, post-training, and for 21 patients again at follow-up at 5-45 mo later	Although the patients with WC did not attain normal performance levels, they experienced significant improvements ($P < .05$) across all the outcomes after the training A subset of patients ($N = 21$) who were available for follow-up after an extended period continued to demonstrate significant improvements in all the outcomes showing that the gains achieved through the treatment program lasted months or in some case years

Wilson et al, 2008[19]	Pilot non-RCT	13 patients (6 women with median age of 49 [34, 63] y in the origami treatment group; 6 women and 1 man with median age of 57 [25, 81] y in the control group) with different wrist/hand injuries attending outpatient hand therapy in a London hospital	*Intervention group*: 1-h session for origami training, once every week for 6 wk, with homework to make origami at home in preparation for the next session *Control group*: 1-h session of conventional hand therapy that included exercises such as using rolling and stretching different putty, once every week for 6 wk	Outcomes were assessed before and after 6 wk of interventions in both the groups: • JTHFT • Subjects were also invited to provide unstructured written responses	The JTHFT scores were not different between the intervention group and the control group at 6 wk (11.8 [1.2, 69.2] s vs 4.3 [−2.6, 9.0] s, $P = .06$) Qualitative data from patients who had origami training revealed 5 themes: encouraging use of hands, supportive environment, challenging activity, enjoyable activity, and future use of origami In general, these themes suggested that patients found origami to be engaging, enjoyable, and yet challenging
Earley and Shannon, 2006[4]	Case report	53-y-old woman with shoulder adhesive capsulitis	Occupation-as-means/purposeful activity *Cointerventions*: • Ultrasound • Passive stretching • Home program of stretching and active motion	• Shoulder ROM (flexion, extension, abduction, horizontal abduction, horizontal adduction, internal rotation, and external rotation) • Numeric Pain Intensity scale	Improvement to ROM in all directions and pain intensity. Because this was a case report, no group statistics were provided
Jack and Estes, 2010[12]	Case report	51-y-old woman diagnosed with lupus and lupus-related arthritis underwent: • Removal of hardware to thumb • Arthrodesis revision • Left open carpal tunnel release and synovectomy, left radius scapholunate fusion, and left index FDS to FDP tendon transfer	• Biomechanical frame of reference initially • Shifted to an occupation-centered approach after 10 wk postsurgery *Cointerventions*: • Ultrasound • Scar massage	• AROM digits • COPM • Assessment of edema using figure-of-8 technique	Improved COPM scores after occupation-centered intervention. Because this was a case report, no group statistics were provided
Toth-Fejel et al, 1998[13]	Case report	40-y-old woman with medial epicondylectomy	Occupation-centered approach for 10 wk	• AROM elbow • Grip strength (kg) • Quality of movement	AROM, grip strength, and quality of movement improved after 10 wk of occupational-centered approach. Because this was a case report, no group statistics were provided

UCLA = University of California, Los Angeles; OT = occupational therapy; OBI = occupation-based intervention; WC = writer's cramp; NIV = average number of inversions in velocity; VAS = visual analog scale; RCT = randomized controlled trial; PNI = peripheral nerve injury; TE = therapeutic exercise; DASH = Disabilities of the Arm, Shoulder and Hand questionnaire; TAM = total active motion; ROM = range of motion; COPM = Canadian Occupational Performance Measure; ADL = activities of daily living; FP-DPC= finger pulp-distal palmar crease; JTHFT = Jebsen-Taylor hand function test; PRWE = patient-rated wrist evaluation; TBSA = total body surface area; FDS = flexor digitorum superficialis; FDP = flexor digitorum profundus; AROM = active range of motion; O-CIMT = occupation-based constraint-induced motor therapy; R-CIMT = rote exercise-based constraint-induced motor therapy.

All the studies, including case reports, reviewed, with the exception of 1,[16] reported positive change after OBI. With respect to the outcome measures, individuals in the OBI groups showed significantly better improvements in the performance scale of the COPM (8.75 ± 1.13 vs 7.56 ± 1.96 at 6 weeks, $P = .03$ and 9.53 ± 0.64 vs 7.62 ± 2.09 after another 4 weeks, $P < .001$[14]; O-CIMT 7.2 [6.6-7.7] and rote-CIMT [R-CMT] 4.9 [4.4-5.5] vs control 3.6 [3.0-4.2] at 1 month after interventions [$P < .001$]),[18] as well as satisfaction scales of the COPM (8.55 ± 1.23 vs 7.44 ± 2.09 at 6 weeks, $P = .05$ and 9.49 ± 0.76 vs 7.6 ± 2.11 after another 4 weeks, $P < .001$[14]; O-CIMT 6.9 [6.5-7.3] and R-CIMT 4.5 [4.1-4.9] vs control 3.2 [2.7-3.7] at 1 month after interventions).[18] A case study involving a complex postsurgical patient with lupus-related arthritis reported gains of 1.8 points in performance and 2.6 points in satisfaction as measured by the COPM after 5 weeks of OBI.[12]

Studies in which UE MSK was examined using the DASH scores reported that individuals receiving OBI experienced reduction in UE MSK compared with the control. Che Daud et al[14] reported that DASH scores were similar in patients who for 6 weeks of in-clinic therapy receiving either OBI + exercise or only exercise (17.23 ± 13.28 vs 21.06 ± 12.58 at 6 weeks, $P = .35$) but significantly better after an additional 4 weeks of continuing exercise program at home (9.5 ± 9.14 vs 18.64 ± 14.84; $P = .02$). Similarly, Guzelkucuk et al[15] demonstrated that OBI involving activities of daily living (ADL) training had superior effect on UE MSK in patients with hand injury, as shown by significant change in the DASH scores (35 ± 17 vs 61 ± 18 at the final follow-up assessment, $P < .001$). Rostami et al[18] also reported a similar trend, demonstrating significantly better DASH scores in individuals with ulnar or median nerve injuries who received O-CIMT versus those who received R-CIMT or were in control groups (O-CIMT 19.6 [15.8-23.3] and R-CIMT 37.4 [33.6-41.2] vs control 53.9 [49.8-58] at 1 month after interventions, $P < .001$). Maciel et al,[16] using PRWE to assess wrist-specific pain and functions in patients who received activity-based interventions, demonstrated no significant differences, with similar PRWE scores at follow-up between the treatment and control groups at the final follow-up (21.4 ± 24.5 vs 24.8 ± 22.2, $P > .05$).

The effect of OBI on performance measures was inconsistent. Improvements were observed in some, whereas no change was observed in others. For example, the individuals with median or ulnar nerve injury receiving O-CIMT showed significant improvements in the box and block test compared with those receiving R-CIMT or control interventions at 1 month after the interventions stopped (O-CIMT 10.1 [9.2-11.0] vs R-CIMT 5.2 [4.2-6.1] and control 3.2 [2.2-4.2], $P < .001$).[18] Hand functions assessed using JTHFT showed significant improvements in patients with hand injury who received ADL-based interventions (4-18 ± 0.9-9 vs 3-9 ± 0.8-5 s at the final follow-up; $P < .001$)[15] and also in pediatric patients with burn injuries (92 s in the OBI group vs 126 s in the rote exercise group).[17] However, those who had origami training for rehabilitation of hand injuries did not experience superior outcomes in the JTHFT when compared with those receiving conventional rehabilitation (11.8 [1.2, 69.2) vs 4.3 [−2.6, 9.0] s, $P = .06$).[19]

The recovery patterns for physical measures, such as grip strength, pinch strength, and total active motion (TAM) (total flexion of the metacarpophalangeal, proximal and distal interphalangeal joints - the total extension loss of those joints = TAM), were inconsistent. Guzelkucuk et al[15] showed that patients with hand injury who received ADL-based interventions had superior benefits in grip (23 ± 14 vs 11 ± 10 kg at final follow-up, $P < .001$) and pinch strength (7 ± 3 vs 3 ± 1 kg at final follow-up, $P < .001$) compared with control groups. Conversely, there was no difference in grip strength between patients with distal radius fracture who received activities-based interventions and those who received conventional treatments (19 ± 14 vs 20.8 ± 11.1 kg, $P > .05$).[16] The same is true of another group of patients with wrist/hand injuries who received OBI with conventional exercises when compared with a group that did only conventional exercise (24.82 ± 9.85 vs 20.29 ± 11.19, $P = .18$).[14] TAM demonstrated significant differences between OBI versus control groups in patients with wrist/hand injuries who received OBI + conventional exercises and those doing only conventional exercises (1203.65 ± 133.6 vs 1035.85 ± 179.84 at final follow-up, $P = .01$).[14] The TAM did not improve in patients with hand injuries who received ADL-based interventions when compared with the control group (195 ± 54 vs 195 ± 35, $P = .58$).[15]

The 2 studies for patients with writer's cramp demonstrated significant improvement in outcomes after intervention, albeit on different metrics. Although 1 study demonstrated significant changes in pain, subjective view of writing, and writing pressure,[9] a second study demonstrated significant differences in the number of inversions in velocity per stroke, number of letters written per minute, and peak velocity.[11] Finally, the study by Barthel et al[8] created its own metric for determining the impact of a multimodal intervention that reports on percentage of return to work and the level of modifications needed to do so.

In summary, there was a significant heterogeneity in the types of diagnoses treated, elements and conceptualization of the OBI, and the outcomes assessed across these studies. This validated our a priori position to not pursue meta-analyses of the outcomes data.

Risk of bias in included studies

The risk of bias was assessed only for the RCT, cohort, and case series studies. The agreement between the reviewers was substantial, as suggested by the raw agreement of 90% and the weighted κ of 0.86 (95% confidence interval, 0.78-0.94). There was a risk of bias present due to some studies that used nonrandomized design, allocation was not concealed, and blinding of patients, therapists, and outcome assessors was lacking. Moreover, there was a substantial loss to follow-up and incomplete reporting of outcomes data across multiple studies. Table 3 summarizes risk of bias in the included studies using the PEDro scale.

Discussion

The results of this review provide preliminary evidence for the use of OBI with patients with UE MSK in hand therapy practice. Although most studies showed that OBI was effective in reducing impairment in body functions, activity limitations, and participation restrictions in individuals with UE MSK, the generalizability of the evidence was limited due to systematic bias in the included studies, inconsistent conceptualization of the OBI, and widely variable dosage and delivery of OBI. This review identifies key gaps in the existing literature concerning the usefulness of OBI in hand

Table 3
PEDro rating for the studies included in the review

Article	1	2	3	4	5	6	7	8	9	10	11	Total score (%)
Che Daud et al, 2016[14]	Y	1	1	1	1	0	1	1	0	1	1	8/10 (80)
Rostami et al, 2017[18]	Y	1	1	1	1	0	1	1	0	1	1	8/10 (80)
Guzelkucuk et al, 2007[15]	Y	1	0	1	0	0	0	1	1	1	1	6/10 (70)
Maciel et al, 2005[16]	Y	1	1	1	0	0	1	0	1	1	1	7/10 (70)
Omar et al, 2012[17]	Y	1	1	1	0	0	0	1	1	1	1	7/10 (70)
Wilson et al, 2008[19]	Y	0	0	1	0	0	0	1	1	1	1	5/10 (50)
Baur et al, 2009[9]	N	0	0	0	0	0	0	1	1	1	0	3/10 (30)
Rostami et al, 2015[10]	Y	0	0	0	0	0	0	1	1	0	1	3/10 (30)
Barthel et al, 1998[8]	Y	0	0	0	0	0	0	1	1	0	0	2/10 (20)
Schenk et al, 2004[11]	Y	0	0	0	0	0	0	0	0	1	1	2/10 (20)

Y = yes; N = no.

therapy practice, which should hopefully provide adequate directions to researchers in further refining the evidence. Clinicians are encouraged to use their experience and clinical judgment in using OBI in their practice, while clearly recognizing the key gaps in the literature. Although this is a limitation of the overall evidence, it reflects the varied definitions, delivery, and metrics of OBI in hand therapy practice.

The levels of evidence were generally high with 6 RCTs (level 1b), 3 cohort studies (level 2b), 1 case series (level 3b), and 3 case reports (level 4). Quality of the studies, as determined by PEDro scores, was widely distributed, with 4 rated as poor, 2 moderate, and 4 excellent (the 3 case reports cannot be assessed by PEDro). Although the outcomes were, in general, superior in subjects receiving OBI, the variations in study designs and the spread in the PEDro scores that reflect methodological quality raise some concerns with the quick adoption of OBI approach in hand therapy practice. In particular, lack of blinding of therapists who assessed treatment outcomes and incomplete reporting of selective data reporting in most non-RCT and some RCTs[15,17] clearly indicate measurement bias. Although it is not required to have multiple well-designed RCTs to help validate the benefits of OBI in UE MSK, measurement bias is a key concern in any intervention study.[31]

The type of interventions and ability to select meaningful activity varied among the studies reviewed. Several had incorporated a specific OBI intervention, such as writing, origami, and 3 daily tasks,[9,11,14,19] whereas others allowed the patient to select from a choice of several activities[15,17] or incorporate the patient's own daily, leisure, or work activities.[4,8,10,12-14,18] Choice of relevant meaningful activity is described as an important element of OBI.[3,23] The 3 case studies[4,12,13] and 2 studies using modified CIMT[10,18] described the extent to which the daily activities in the patients' lives were incorporated into OBI. On the surface, differentiated choice of activity within the context of an RCT or cohort design can be seen as complex when trying to control for confounding variables; however, it appears feasible, particularly when framing the larger category of an occupation-based approach as the independent variable.

The metrics used to assess OBI varied widely. Assessment of occupations or *activities* and *participation* was not a necessary precursor for inclusion in this systematic review. Interest as to whether occupations can impact a patient at any point in his or her health continuum—body structures/functions, activity, or participation—makes any measure relevant when examining the impact of OBI. The selection of outcomes measures when designing a study can be a combination of both art and science. An intervention may have affected change, but understanding the type of change one can expect from a particular intervention is a necessary first step. Appreciating the specific qualities of an assessment tool or questionnaire to highlight that change is the second equally important step. Failure to recognize both what the intervention actually impacts and how best to highlight that impact may unintentionally garner results that show the intervention to be ineffective.

Outcomes that assessed occupations in the studies reviewed included COPM, DASH, and PRWE. Significant differences were found in OBI groups measured by COPM and DASH. The absence of significant differences between groups as measured by PRWE[16] may be related more to the study's design, as will be discussed later. Of the performance measures, the box and block test[10,18] and JTHFT,[15,17] in 2 studies each, show significant differences between groups. Physical measures were diverse, with pinch strength, grip strength, ROM, and sensation measures detecting significant differences in only some of the studies and at select time points. Reports of pain were significantly different between groups in 2 of the studies.[14,17] The self-assessment manikin scale uses pictures to report an emotional reaction. This scale, used in the study by Rostami et al,[18] found significant differences between groups on the 3 dimensions measured: pleasure, arousal, and dominance. Qualitative data reported in 2 studies reviewed[4,19] described patient satisfaction with OBI. Several qualitative studies were not included in this review, but they highlight the patients' and therapists' experiences with OBI, capturing the advantages and disadvantages in a different manner than quantitative outcome measures.

Two studies warrant further discussion. A study by Barthel et al[8] incorporated OBI as one of several interventions. The design of the study was intended to retrospectively describe a cohort of patients who had undergone a multidisciplinary treatment program. The specific impact of OBI could not be discerned in this article. In hindsight, it may have been more prudent to include only research that could identify the specific outcome of OBI. A second study by Maciel et al[16] found no significant differences between 2 groups of patients who underwent conservative management for distal radius fractures, one taught exercises by a physiotherapist for 1-2 sessions and another receiving activity-focused therapy for an average of 4.4 sessions, with both groups improving over time. The authors determined that the activity-focused therapy yielded no beneficial advantage, with 1 therapy visit being sufficient. Some possible contributions to those findings are the power analysis being calculated to find a difference in grip strength, attrition causing group size to fall below suggested power analysis, physiotherapists providing both interventions, lack of clarity as to whether information given to the control group was strictly limited to exercise, and whether other PROs would have better captured the participants' functional limitations.[16] Alternately, from a dispassionate scientific perspective, it might be concluded that OBI, as incorporated in this study, does not necessarily result in a different outcome.[16]

The focus of this study differs from other systematic reviews of patients with UE MSK. Reviews by Amini,[20] Marik and Roll,[21] and Roll and Hardison[22] use a diagnostic cohort (ie, adults with musculoskeletal conditions) as the central focus and examine the evidence for all interventions within the scope of practice of occupational therapy. In contrast, this article and an article by Sutton et al[32] uses an intervention as the central focus, reviewing studies using OBI and multimodal care, respectively, among a variety of UE MSK diagnoses. Amini,[20] Marik and Roll,[21] and Roll and Hardison[22] found few studies that incorporated OBI in their reviews, and each noted the paucity of evidence for OBI intervention in the literature. The review by Sutton et al[32] did not include studies with OBI intervention. In a related study, Hardison and Roll[33] found that including work simulation activities in their intervention was one predictor of successful outcomes and encouraged the use of OBI. Overall, there are few studies that consider OBI in the literature, those that do have demonstrated some level of evidence but consistently comment on the need for more.

Strengths of this review are 2-fold. First, from a methodological perspective, it includes a comprehensive search strategy, as well as a duplicated literature search, duplicated eligibility assessment, assessment of agreement in selecting the studies, and assessment of risk of bias. A comprehensive data extraction process ensured that the required information from the included studies was retrieved with greater accuracy. Second, from a clinical-philosophical perspective, this review examines OBI, an intervention of growing interest and growing evidence.

Limitations of this review include the quality of overall evidence, which was affected by poor methodological qualities of the included studies. In part, this emanated from the fact that many primary studies included were of methodological designs that are inherently biased and considered low level of evidence.[34] This included case series design[8-11] and single case reports.[4,12,13] The key concerns with these studies are lack of comparison group, randomization, or blinding of patients, therapists, and outcome assessors. Even those who used RCT design, which is considered high-level evidence, had issues with allocation concealment,[15] lack of blinding of outcome assessors,[15,17] and no intention-to-treat analyses in the event of high participant attrition.[14,18] Another limitation of this study is the difficulty in synthesizing the data in a simple manner. The diversity of interventions, modes of delivery, and outcome measures lend themselves to a more complex answer to our research question.

The implications of this study are positive. The findings indicate preliminary evidence to support use of OBI with patients with UE MSK. As the scientific work of exploring OBI grows, clinicians can more confidently incorporate occupations in daily practice. Reading about how other clinicians and researchers have integrated OBI in individual patients, as well as evaluating research studies, can stimulate thought about how we each can use this intervention as the subject of future research and incorporate it into our clinical practice, despite barriers of time, physical setting, and lack of necessary supplies. The growing body of research on this topic indicates a confluence of interest in integrating meaningful activities into the daily treatment of patients with UE MSK, as well as awareness that sometimes the missing link between motion and function can be bridged by the subconscious combination of movements elicited in functional hand use.

Additional work is needed to provide further evidence using design methods of high quality to advance the research on this topic. Clear and consistent use of OBI terminology is an important first step toward drawing larger conclusions about its effectiveness as a treatment intervention. Definitions provided by Fisher,[2] as well as the work of Colaianni et al,[6] Che Daud et al,[23] and Amini,[35] may serve as useful guides to shaping a broader consensus of what constitutes occupation-based hand therapy. Careful examination of the varied types of OBI, dosage, delivery, and outcome measures used thus far can stimulate thoughtful studies in the future. Directions for future research include more well-designed RCTs using clearly defined methods of OBI, giving patients the opportunity to select occupations that are meaningful to them, and the use of outcomes measures that capture patients' valued activities and the changes likely to occur with the use of OBI.

In conclusion, evidence supporting use of OBI contains the caveat that there are limitations in overall quality of the existing body of work and a need for carefully designed study in the future. Still, the studies reviewed here have made substantive inroads, providing clinicians with an impetus to explore the use of OBI in daily practice. With indication of growing interest in this treatment intervention, it is hoped that, going forward, there will be a continued commitment to furthering research of OBI in all its dimensions.

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References

1. American Occupational Therapy Association. Occupational therapy practice framework: domain & process (3rd edition). *Am J Occup Ther*. 2014;68:S1–S48.
2. Fisher AG. Occupation-centred, occupation-based, occupation-focused: same, same or different?. Previously published in Scandinavian Journal of Occupational Therapy 2013;20:162-173 *Scand J Occup Ther*. 2014;21(suppl 1):96–107.
3. Colaianni D, Provident I. The benefits of and challenges to the use of occupation in hand therapy. *Occup Ther Health Care*. 2010;24(2):130–146.
4. Earley D, Shannon M. The use of occupation-based treatment with a person who has shoulder adhesive capsulitis: a case report. *Am J Occup Ther*. 2006;60(4):397–403.
5. Gray JM. Putting occupation into practice: occupation as ends, occupation as means. *Am J Occup Ther*. 1998;52(5):354–364.
6. Colaianni DJ, Provident I, DiBartola LM, Wheeler S. A phenomenology of occupation-based hand therapy. *Aust Occup Ther J*. 2015;62(3):177–186.
7. World Health Organization. *International Classification of Functioning, Disability and Health: ICF*. Geneva: World Health Organization; 2001.
8. Barthel HR, Miller LS, Deardorff WW, Portenier R. Presentation and response of patients with upper extremity repetitive use syndrome to a multidisciplinary rehabilitation program: a retrospective review of 24 cases. *J Hand Ther*. 1998;11(3):191–199.
9. Baur B, Fürholzer W, Marquardt C, Hermsdörfer J. Auditory grip force feedback in the treatment of writer's cramp. *J Hand Ther*. 2009;22(2):163–171.
10. Rostami HR, Khayatzadeh Mahany M, Yarmohammadi N. Feasibility of the modified constraint-induced movement therapy in patients with median and ulnar nerve injuries: a single-subject A-B-A design. *Clin Rehabil*. 2015;29(3):277–284.
11. Schenk T, Bauer B, Steidle B, Marquardt C. Does training improve writer's cramp?: an evaluation of a behavioral treatment approach using kinematic analysis. *J Hand Ther*. 2004;17(3):349–363.
12. Jack J, Estes RI. Documenting progress: hand therapy treatment shift from biomechanical to occupational adaptation. *Am J Occup Ther*. 2010;64(1):82–87.
13. Toth-Fejel GE, Toth-Fejel GF, Hedricks CA. Occupation-centered practice in hand rehabilitation using the experience sampling method. *Am J Occup Ther*. 1998;52(5):381–385.
14. Che Daud AZ, Yau MK, Barnett F, Judd J, Jones RE, Muhammad Nawawi RF. Integration of occupation based intervention in hand injury rehabilitation: a randomized controlled trial. *J Hand Ther*. 2016;29(1):30–40.
15. Guzelkucuk U, Duman I, Taskaynatan MA, Dincer K. Comparison of therapeutic activities with therapeutic exercises in the rehabilitation of young adult patients with hand injuries. *J Hand Surg [Am]*. 2007;32(9):1429–1435.
16. Maciel JS, Taylor NF, McIlveen C. A randomised clinical trial of activity-focussed physiotherapy on patients with distal radius fractures. *Arch Orthop Trauma Surg*. 2005;125(8):515–520.
17. Omar MTA, Hegazy FA, Mokashi SP. Influences of purposeful activity versus rote exercise on improving pain and hand function in pediatric burn. *Burns*. 2012;38(2):261–268.
18. Rostami HR, Akbarfahimi M, Hassani Mehraban A, Akbarinia AR, Samani S. Occupation-based intervention versus rote exercise in modified constraint-induced movement therapy for patients with median and ulnar nerve injuries: a randomized controlled trial. *Clin Rehabil*. 2017;31(8):1087–1097.
19. Wilson LM, Roden PW, Taylor Y, Marston L. The effectiveness of origami on overall hand function after injury: a pilot controlled trial. *Br J Hand Ther*. 2008;13(1):12–20.
20. Amini D. Occupational therapy interventions for work-related injuries and conditions of the forearm, wrist, and hand: a systematic review. *Am J Occup Ther*. 2011;65(1):29–36.
21. Marik TL, Roll SC. Effectiveness of occupational therapy interventions for musculoskeletal shoulder conditions: a systematic review. *Am J Occup Ther*. 2017;71(1), 7101180020p1-p11.
22. Roll SC, Hardison ME. Effectiveness of occupational therapy interventions for adults with musculoskeletal conditions of the forearm, wrist, and hand: a systematic review. *Am J Occup Ther*. 2017;71(1), 7101180010p1-p12.
23. Che Daud AZ, Yau MK, Barnett F, Judd J. Occupation-based intervention in hand injury rehabilitation: experiences of occupational therapists in Malaysia. *Scand J Occup Ther*. 2016;23(1):57–66.
24. Higgins JPT, Green S. *Cochrane Handbook for Systematic Reviews of Interventions, Version 5.1.0* [Updated March 2011]. The Cochrane Collaboration, 2011. Available at: http://handbook.cochrane.org. Accessed May 13, 2018.
25. McHugh ML. Interrater reliability: the kappa statistic. *Biochem Med*. 2012;22(3):276–282.
26. Buscemi N, Hartling L, Vandermeer B, Tjosvold L, Klassen TP. Single data extraction generated more errors than double data extraction in systematic reviews. *J Clin Epidemiol*. 2006;59(7):697–703.
27. de Morton NA. The PEDro scale is a valid measure of the methodological quality of clinical trials: a demographic study. *Aust J Physiother*. 2009;55(2):129–133.
28. Maher CG, Sherrington C, Herbert RD, Moseley AM, Elkins M. Reliability of the PEDro scale for rating quality of randomized controlled trials. *Phys Ther*. 2003;83(8):713–721.
29. Moreira RF, Foltran FA, Albuquerque-Sendin F, Mancini MC, Coury HJ. Comparison of randomized and non-randomized controlled trials evidence

regarding the effectiveness of workplace exercise on musculoskeletal pain control. *Work*. 2012;41(suppl 1):4782–4789.

30. Fritz CO, Morris PE, Richler JJ. Effect size estimates: current use, calculations, and interpretation. *J Exp Psychol Gen*. 2012;141(1):2–18.
31. Chess LE, Gagnier J. Risk of bias of randomized controlled trials published in orthopaedic journals. *BMC Med Res Methodol*. 2013;13:76.
32. Sutton D, Gross DP, Côté P, et al. Multimodal care for the management of musculoskeletal disorders of the elbow, forearm, wrist and hand: a systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. *Chiropr Man Therap*. 2016;24:8.
33. Hardison ME, Roll SC. Factors associated with success in an occupational rehabilitation program for work-related musculoskeletal disorders. *Am J Occup Ther*. 2017;71(1), 7101190040p1-p8.
34. Howick J, Chalmers I, Glasziou P, et al. *The Oxford Levels of Evidence 2*. Oxford Centre for Evidence-Based Medicine, 2017. Available at: http://www.cebm.net/index.aspx?o=5653. Accessed May 13, 2018.
35. Amini D. AOTA fact sheet: the unique role of occupational therapy in rehabilitation of the hand. Available at: https://www.aota.org/~/media/Corporate/Files/AboutOT/Professionals/WhatIsOT/RDP/Facts/Hand%20Therapy%20fact%20sheet.pdf. Accessed March 25, 2018.

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Quiz: # 602

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#1. The study design is
   a. qualitative
   b. a case series
   c. a systematic review
   d. RCTs

#2. The ultimate goal of hand therapy is
   a. successful resumption of daily activity
   b. the relief of pain and restoration of ROM
   c. return to work
   d. OBI

#3. Central to OBI is
   a. avoidance of home exercise programs
   b. not having the patient engage in restoration of ROM techniques
   c. not having the patient engage in pain management techniques
   d. having the patient engage in functional activity as a part of the hand therapy intervention

#4. Currently in order to promote greater clinical acceptance and utilization of the OBI concept there is a need for
   a. AOTA and ASHT endorsement of its use
   b. the development of definitions
   c. clear and consistent use of OBI terminology
   d. continuing educational programs which teach clinical techniques of OBI

#5. One limitation to the OBI approach to hand therapy is that is the exclusive province of occupational therapists, and thus may not be utilized by physical therapists
   a. true
   b. false

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