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Effectiveness of interventions to improve therapy adherence in people with upper limb conditions: A systematic review

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ABSTRACT

Study Design: Systematic review.
Introduction: Patient adherence to orthosis wear and/or prescribed exercises improves functional outcome after acute injury and can prevent deformities, contractures, and reinjury of tissues. This is the first systematic review to review the evidence of the effectiveness of interventions to improve treatment adherence in children and adults with acute or chronic upper limb injuries or conditions.
Purpose of the Study: The purpose of this study is to establish the effectiveness of interventions to improve hand therapy adherence in people with upper limb conditions and to report on outcome measures used when reporting adherence.
Methods: A literature search of MEDLINE (OVID), Embase (OVID), CENTRAL (OVID), CINAHL (EBSCO), and EmCare (OVID) (from inception to March 2017) was undertaken. Studies were selected if they met the following inclusion criteria: clinical trials; in adults or children with any injury or condition affecting the upper limb including acute trauma and injury; chronic and acquired musculoskeletal conditions; and neurological conditions. Two independent assessors rated the study quality and risk of bias using the Cochrane Collaboration tool for assessing the risk of bias.
Results: Eight studies met the inclusion criteria. Study quality ranged from 3 to 6 out of 7 points on the Cochrane risk of bias tool. There were 4 categories of intervention for improving adherence: orthosis/cast material/design; orthosis wear schedule; patient education mode for home exercise programs; and behavioral approaches. Due to heterogeneity of condition acuity, interventions, and outcomes reported, it was not possible to pool the results from all studies. Therefore, a narrative best evidence synthesis was undertaken. There is weak evidence from a very small number of trials that orthosis/cast material has no influence on treatment adherence in acute or chronic conditions and mode of patient education (audio-visual vs written) has no effect in acute conditions. There is low-to-moderate quality of evidence in support of behavioral interventions for achieving treatment adherence in chronic rheumatoid arthritis.
Conclusion: Behavioral approaches that encourage self-efficacy are likely to be useful in achieving treatment adherence in populations with chronic upper limb conditions. There is insufficient evidence for other interventions aimed at improving adherence in acute upper limb injuries and conditions.

Introduction

Background

Consumer nonadherence with medical or therapeutic treatment has consistently been shown to reduce treatment benefits, affect recovery, increase the risk of disability, and bias assessment of treatment efficacy.[1-3] A meta-analysis found the odds of a favorable outcome in a variety of medical conditions, both acute and chronic, are trebled in patients who adhere to treatment recommendations when compared to those who do not.[4]

Myriad treatment interventions to address the problem of low adherence have been studied in the health literature, with a particular focus on prescribed medication. A systematic review of interventions for enhancing medication adherence[5] found that, for short-term treatments (for infections or transient allergies), several

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simple interventions (such as counseling patients about the importance of adherence, providing written instructions, and follow-up phone calls) improved adherence but did not enhance the clinical outcome. Studies on long-term treatments for various chronic medical diagnoses have included trials of simplified medication dose regimens as well as more complex strategies, including combinations of more thorough patient instructions and counseling; reminders; close follow-up; supervised self-monitoring; rewards for success; family therapy; couple-focused therapy; psychological therapy; crisis intervention; and telephone follow-up. Reported effectiveness was limited, and results needed to be balanced with the considerable amount of effort and resources they consumed. The authors concluded that "If there is a common thread to these at all, it is a more frequent interaction with patients with attention to adherence… There is no evidence that low adherence can be 'cured.' Thus, efforts to improve adherence must be maintained for as long as treatment is needed."[5(p19)]

In the hand therapy literature, there is evidence that patient adherence to orthosis wear and/or prescribed exercises predicts positive functional outcome after acute injury[6] and can assist in avoiding costly secondary surgery for preventable deformities, contractures, and reinjury of tissues.[7] The rate of adherence to orthosis wear in hand therapy populations varies markedly in published literature (32%-60.5%).[8-12] The true rate is likely to be lower in practice, due to factors such as reporting bias, lack of validated measurement tools, and variable definitions of adherence used by researchers.

While a multitude of articles exist regarding the effectiveness of treatment modalities for specific injuries of the hand and upper limb, a relative paucity of literature has been published on the value of interventions to achieve optimal patient adherence. A systematic review examining adherence with therapeutic orthosis wear in acute upper limb injuries[7] found no consistent correlation between adherence and social and economic condition—related factors but found some evidence that treatment/therapy-related factors (such as immediacy of benefit, orthosis comfort, and minimizing interference with lifestyle and daily living activities) could improve orthosis adherence.

Purpose of the study

This systematic review aims to establish the effectiveness of interventions to improve hand therapy adherence in people with upper limb conditions. Additionally, the review aims to report on outcome measures used when reporting adherence.

Methods

Information sources and search strategy

This review was registered prospectively on PROSPERO International Prospective Register of Systematic Reviews (CRD42017064836). The search strategy aimed to find published studies reported from database inception to March 2017. After an initial search for articles in MEDLINE and Embase, an analysis of the text words contained in the title and abstract and of the index terms used to describe these articles was conducted. A second search using all identified key words and index terms was then undertaken across all included databases: MEDLINE (OVID), Embase (OVID), CENTRAL (OVID), CINAHL (EBSCO), and EmCare (OVID). Studies published in English were considered for inclusion in this review. The final searches were based on the MEDLINE search strategy (Appendix A). CENTRAL, Embase, CINAHL, and EmCare searches were adapted as appropriate to the specifications for these databases.

Hand searching and reference checking of citations and reference lists were also undertaken. Gray literature and reference lists from relevant articles were also reviewed to identify additional articles.

Full search strategies for each database are available on request from the corresponding author.

Eligibility criteria

We included clinical trials (randomized controlled trials [RCTs], quasi RCTs, controlled before-after studies, and good-quality comparative cohort studies) that employed an intervention, mostly or wholly based on psychological or educational theories, with the stated aim of examining its effect on adherence to conservative therapy for an upper limb injury or condition. Participants were people with any injury or condition affecting the upper limb (shoulder, arm, elbow, forearm, wrist, hand, or fingers), including acute trauma and injury (eg, fracture/s, tendon, nerve, ligament injuries), chronic and acquired musculoskeletal conditions (eg, arthropathy, tendinopathy, neuropathy), and neurological conditions (eg, acquired brain injury, stroke, cerebral palsy) were considered. Other inclusion criteria included the reporting of at least 1 adherence-related outcome, such as adherence with the treatment protocol (including prescribed orthosis wear time), attendance at agreed therapy sessions, and/or completion of recommended exercises.

Studies were excluded using the following criteria: published in non-English language; not a clinical trial; or reported only as conference abstract.

Data extraction and assessment of methodological quality

Two review authors (T.C. and L.Rob.) independently screened the titles and abstracts of all the studies identified as a result of the search. Any disputes were resolved by the last author (L.O.B.). Full-text publications were screened independently by 2 authors (T.C. and L.Rob.) to identify studies to be included in the review and identify and record reasons for excluding particular studies. When 2 or more studies clearly resulted in multiple publications from the same participant group, the study with a follow-up period comparable to other included studies was included and the others excluded. Any disagreements were resolved by consensus or by involving a third person (L.O.B.).

Data extraction and management

Two review authors (T.C. and L.Rob.) independently extracted the following study characteristics from included studies, and authors of the original articles were contacted if there were relevant missing data or uncertainties:

1. Methods: study design, total duration of the study, study location, study setting, withdrawals, and date of study.
2. Participants: number, mean age or age range, gender, upper limb condition, diagnostic criteria if applicable, inclusion criteria, and exclusion criteria.
3. Interventions: description of intervention, comparison, duration, intensity, content of both intervention and control condition, and cointerventions.
4. Outcomes: description of primary and secondary outcomes specified and collected, and at which time points reported.
5. Notes: funding for trial and any notable conflicts of interest of trial authors.

The methodological quality of the included studies was independently assessed by 2 review authors (T.C. and L.Rob.) using the

Cochrane Collaboration tool[13] for assessing the risk of bias and consensus reached among all authors in the case of any disagreements. The risk of bias tool addresses 6 specific domains, namely sequence generation, allocation concealment, blinding, incomplete outcome data, selective outcome reporting, and other issues, with assessors assigning "high risk," "low risk," or "unclear" to each criterion.

Synthesis of results

One review author (L.O.B.) transferred data into Review Manager software. Two review authors (L.O.B. and L.Rob.) double checked that data were entered correctly by comparing the data presented in the systematic review with the study reports. Where possible, outcome data for each study were entered into the data tables to calculate the treatment effects. We expressed dichotomous outcome data as risk ratios (also known as relative risk [RR]) with 95% confidence intervals (CIs). We were unable to combine continuous data from any trials due to heterogeneity of participant groups or measures used; therefore, a narrative analysis of these results is presented.

Results

Study selection

The search yielded 2747 potentially relevant articles. After duplication removal and record screening of abstract and title, 20 full-text articles were retrieved. Of these, 8 articles were retained for final analysis. The flowchart on study selection is presented in Figure 1.

Study characteristics and methodological quality

Characteristics of included studies are shown in Table 1, and the appraisal of risk of bias is presented in Figure 2. In all studies, it was difficult to achieve participant blinding due to the nature of the intervention. The method of random allocation, assessor blinding, concealed allocation, and losses to follow-up were inconsistently reported.

A total of 495 individuals (57% male) with upper limb injuries or conditions were involved across all studies. Only 1 study[14] focused on pediatric participants (aged <16 years); all others included adult populations. Four studies included acute injuries; 1 was confined to zone 1 extensor tendon injuries[10]; 1 included various traumatic hand injuries (including distal radius fracture, flexor tendon repair, flexor pollicis longus repair, and extensor tendon zones 3-7[15]), and 1 included people following arthroscopic full-thickness rotator cuff repair surgery.[16] Of the 4 studies examining adherence in chronic conditions, 3 included people with rheumatoid arthritis (RA)[17-19] and 1[12] included people with carpal tunnel syndrome (CTS).

Five authors were contacted for additional data regarding how adherence was defined and classified or to clarify study methodology and/or reported results to enable evaluation of quality and comparison of results. Two[10,15] supplied this with data from one of these allowing meta-analysis for the outcome "audiovisual vs written instruction."

Interventions

We have summarized the interventions (based on published report) in Table 1. Broadly, there were 4 categories of intervention aimed at improving adherence: the first was related to the orthosis/cast material or design (3 studies were in this category [10,14,17]); the second focused on orthosis wear schedules[12]; the third focused on the mode of patient education for home exercise programs (audiovisual vs written instruction[15, 16]); and the fourth used behavioral approaches aimed at building positive patient/therapist relationships and improving participants' sense of self-efficacy.[18,19]

Outcomes

Primary outcomes were the percentage of participants fully, partially, or not adherent at specified follow-up times to either (1) recommended orthosis wear time; (2) achieving a threshold value of prescribed exercise (measured using patient written logs or

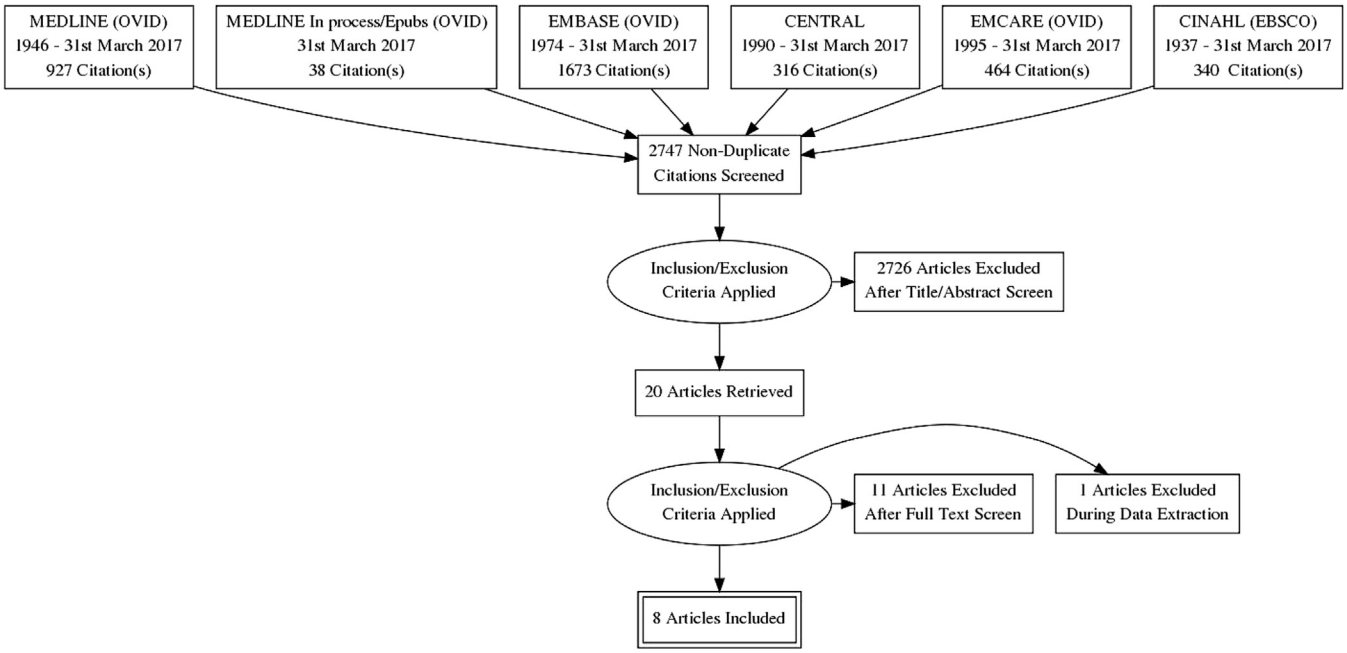

Fig. 1. PRISMA flow diagram. PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses.

Table 1
Characteristics of the included studies

Authors (year)	Study design	Outcomes measured	Patient characteristics	*N*	Males	Study location	Delivery of intervention	Intervention	Control
Callinan et al. (1995)	RCT—repeated measures design (participants acted as their own controls)	Adherence with prescribed hours of orthosis wear	Adults with RA (mean 14.5 y from onset, range: 1 to 53); mean age: 51 y (range: 19 to 76)	39	3	Hand clinic in a hospital, USA	Individual	Experimental treatment periods (28 d) included treatment of dominant hand with (1) soft orthosis—cotton padded wrap with custom-fabricated 1/16 inch thermoplastic insert; (2) hard orthosis—1/8 inch thermoplastic orthosis	No orthosis.
O'Brien et al (2011)	RCT	Adherence with prescribed hours of orthosis wear	Acute Doyle 1a ($n = 36$) or 1b ($n = 28$) mallet finger injury; mean age: 37.6 y (range: 11-86); mean days after injury: 4.6 d	64	42	Two urban public hospitals, Australia	Individual	(1) Dorsal padded aluminum orthosis (13-mm width) manually molded to produce a buckle over the DIPJ to prevent direct pressure that was fixed to the finger using Durapore or Elastoplast 13-mm strapping tape; (2) custom-made circumferential thermoplastic orthosis constructed from 1.6-mm Orfit Classic Soft microperforated orthoses were to be worn continuously for 8 wk	Stack orthosis—The appropriate size was selected for each participant with the aim of achieving the firmest fit without compromising circulation. This was assessed at each review and changed if necessary.
Walker et al (2000)	RCT	Adherence with prescribed hours of orthosis wear	Carpal tunnel syndrome confirmed by electrodiagnostic testing; mean age: 60 years (range: 44 to 81); similar at baseline in age, employment, hand use, and severity	24	23	Electrodiagnostic Lab at a Veterans Administration Medical Center, USA	Individual	Custom-made, thermoplastic, lightweight, low-profile, neutral-positioned wrist orthosis worn full time. No work or activity restrictions were provided.	Same orthosis as intervention, worn at night time only. No work or activity restrictions were provided.
Davidson et al (2016)	RCT	Adherence with prescribed hours of orthosis/cast wear	Isolated fifth metacarpal neck fracture with $<45^\circ$ angulation and no rotational deformity, < 16 y, presentation < 1 wk from DOI	40	36	Pediatric tertiary hospital	Individual	Custom-made, thermoplastic orthosis that immobilized the MCPJs of the little and ring finger in 70° of flexion, leaving the IPJs and wrist joints free, worn full time for 3 wk.	Conventional plaster of Paris forearm-based ulnar gutter orthotic device fabricated into a position of safety (20° wrist extension, $^\circ$ MCPJ flexion, full IPJ extension, encompassing the fourth and fifth rays, worn full time for 3 wk.)
Kingston et al (2014)	RCT	Number of exercise sessions completed	Traumatic hand injury which had treatment protocols (distal radius fracture, flexor tendon repair, flexor pollicis longus repair, and extensor tendon zones 3-7 repair); median age: 35 y (18-75)	53	40	Occupational therapy department at a hospital	Individual	Standard care (splinting, wound and edema management, home exercise protocol, brochure) and an instructional hand care/exercise video/DVD. Weekly appointments for 6 wk (average 30-min duration, exercises were checked for correctness and understanding) in addition to standard care as per treatment protocols. Participants were advised to progress to the next stage of the DVD as clinically indicated.	Standard care and weekly appointments, plus a brochure describing graded exercises as clinically indicated.

Roddey et al (2002)	RCT	Number of exercise sessions completed	Full-thickness rotator cuff tear confirmed by MRI undergoing arthroscopic repair, mean age: group 1 = 58.7 y; group 2= 57.2 y (34.6-78)	108	69	Orthopedic surgeon clinic	Individual	Postoperative evaluation (2, 6, 12, and 24 wk), instructional videotape provided during hospital admission.	Postoperative evaluation, 4 one-on-one instruction sessions with a physical therapist.
Hammond and Freeman (2001)	RCT	Joint protection behaviors	Diagnosis of RA by rheumatology consultant with last 5 y, aged 18-65 y, experiencing hand pain on activity caused by RA only; no statically significant differences between groups for age, disease duration, or socioeconomic background	127	30	Two public hospital rheumatology clinics	Group	Educational-behavioral joint protection program: 4 2-h weekly meetings based on the health belief model and theories of social learning and self-management conducted by an experienced rheumatology OT. Participants were provided with an information pack and workbook detailing the principles of joint protection. The program applied educational, behavioral, motor learning, and self-efficacy–enhancing strategies, as well as a range of educational methods to match different group members' learning styles.	Standard education program: 4 2-h weekly meeting from various health professionals that covered information about RA pathophysiology; principles and demonstrations of joint protection and energy conservation; identification and solutions for problem activities; and assistive devices.
Feinberg (1992)	RCT	Adherence with prescribed hours of orthosis wear	Diagnosis of RA, functional class I or II, outpatient, referred first time for resting orthosis; mean age: 48.8 y; mean duration of symptoms: 4.6 y; no statically significant differences in groups at baseline for pain severity of duration of morning stiffness	40	40	OT department at a rheumatology clinic	Individual	Adherence-enhancing treatment: (1) positive comments from receptionist about the therapist and people's perspectives of orthoses, (2) OT stressed the use of learning principles associated with effective patient education and assessed expectations about the clinical encounter, provided encouragement regarding ability to assume responsibility for the prescribed treatment program successfully using an affirmative tone, completed follow-up phone calls (~2 wk) after orthotic fabrication to convey further sense of caring to the patient by checking fit and symptom relief	Standard treatment: (1) only greeted by receptionist with no extensive conversation, (2) OT employed standard treatment approaches and fabricated an orthosis as prescribed, provided sufficient instruction to permit correct use of orthosis, but other aspects of therapeutic relationship were deemphasized.

MRI = magnetic resonance imaging; RA = rheumatoid arthritis; RCT = randomized controlled trial; OT = occupational therapy/ist; DIPJ = distal inter-phalangeal joint; DOI = date of injury; MCPJ = metacarpo-phalangeal joint; IPJ = inter-phalangeal joint.

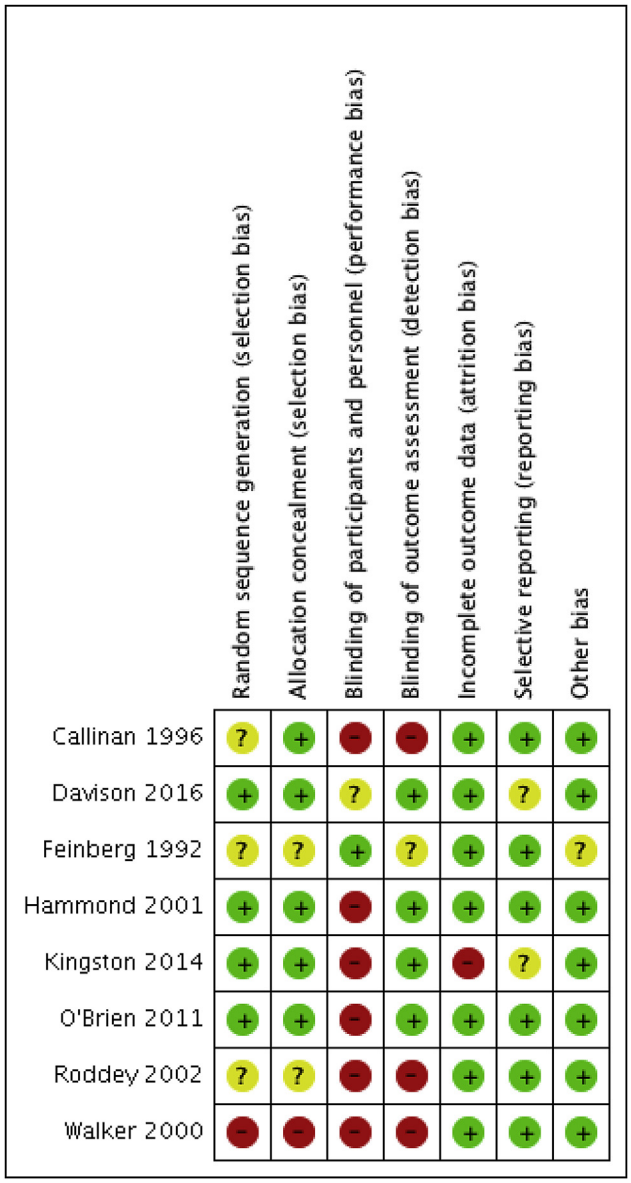

Fig. 2. Risk of bias summary: review authors' judgments about each risk of bias item for each included study. + = low risk; ? = unclear risk; − = high risk; CI = confidence interval.

verbal reports of number of exercises completed); and/or (3) clinic attendance. One other measure of adherence used by study authors was the Joint Protection Behaviour Assessment,[20] used by Hammond and Freeman.[19] This is a therapist-rated tool involving observation of the patient's use of joint protection methods while performing 20 daily living tasks. The 1 pediatric study used parental report regarding the child's achievement of orthosis or plaster cast wear for 100% of the recommended time. As issues for child and adult participants are likely to be different, they were not included in the meta-analysis.

For the purpose of meta-analysis, we reported results for each intervention category separately for populations with acute injuries (where strict adherence to orthosis wear and exercise may be considered more crucial in terms of protecting healing structures and preventing complications) and chronic conditions (where patients may use orthoses to relieve symptoms according to their own judgment). A narrative analysis was undertaken when there was only 1 study in the comparison or where studies did not use the same measure of adherence. Only 1 outcome (audiovisual vs written material) allowed pooling of data from 2 studies.

Orthosis/cast material

Only one of the studies examining acute injuries[10] reported orthosis wear adherence and found no difference between groups who received prefabricated, aluminum, or custom-molded thermoplastic orthosis for mallet finger. For chronic conditions, again only 1 study was included,[17] which compared padded with hard thermoplastic resting orthoses for RA. The authors defined adherence as wearing the orthosis for 50% of the prescribed time and reported that differences between groups (82% vs 67%, respectively) was significant; however, post hoc calculations performed for this review do not support this ($P = .13$).

Orthosis wear schedule

There were no studies examining acute injuries that examined this intervention, and only 1 including a chronic condition, CTS, in which participants were instructed to wear their orthosis full time vs nighttime only for 6 weeks.[12] In that study, the authors found an unintended crossover effect, in that some in the nighttime-only group also wore their orthosis during the day. Complete (or near-complete) nighttime wear of orthotic devices was reported by 85% of the nighttime-only group, and by 100% of the full-time group. Complete to near-complete daytime wear was reported by only 27% of hands in the full-time group, with the remainder reporting partial adherence, suggesting that full-time wear for 6 weeks is not achievable for most people with CTS.

Mode of patient education for home exercise program (audiovisual vs written material)

There were no chronic studies that examined this intervention. Two studies examining acute injuries[15,16] involving 161 participants were included in these meta-analyses, which found no significant difference in the percentage of participants fully adherent (RR = 0.74 [95% CI: 0.54; 1.02]; $P = .51$) or partially adherent (RR = 1.08 [95% CI = 0.57; 2.03]; $P = .82$) with home exercise programs.

Results are presented as forest plots (Figs. 3 and 4). The diamond at the bottom shows the result when all the individual studies are combined together and averaged, and the horizontal points of the diamond are the limits of the 95% CIs. As adherence is a desirable outcome in this review, a RR greater than 1.0 indicates a desirable effect for the intervention, and a RR less than 1.0 is undesirable. In both our analyses, the 95% CIs included the value of 1, meaning results were not significant.

Behavioral approaches to enhance patient/therapist relationship and self-efficacy

There were no studies examining acute injuries that examined this intervention. Two studies investigated behavioral approaches for adults with RA but measured different outcomes. The first[19] compared usual care with a group joint-protection education program underpinned by the Health Belief Model that applied educational behavioral motor learning and self-efficacy–enhancing strategies to increase adherence. The authors found a statistically significant mean difference between groups on the Joint Protection Behaviour Assessment (12.8 points on a 40-point scale; $P < .001$) at 12 months after intervention. The authors did not state whether this represented a clinically important difference. The second compared usual care with an individual intervention which combined patient education based on adult learning principles with staff communication (from both the therapist and receptionist) that encouraged patients to expect a favorable outcome.[18] This study found nonsignificant differences between groups in number of days/months of orthosis wear at 28 and 56 days, but this was

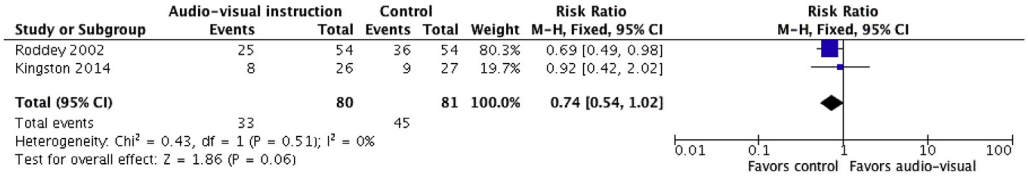

Fig. 3. Forest plot of comparison: audiovisual instruction vs written (control)–full exercise adherence. CI = confidence interval.

possibly due to unexpectedly high adherence rates in both groups (82.5% in the experimental group; 64.6% in the control) and small sample size ($N = 40$).

Discussion

Summary of evidence

This is the first systematic review to review the evidence of the effectiveness of interventions to improve treatment adherence in children and adults with acute or chronic upper limb injuries or conditions. The majority of included studies were published prior to the year 2010, when Consolidated Standards of Reporting Trials guidelines for RCTs were introduced[21] and were poorly or inconsistently reported.

We found weak evidence from a very small number of trials that orthosis/cast material has no influence on treatment adherence in acute or chronic conditions, and mode of patient education (audiovisual vs written) has no effect in acute conditions. This is consistent with a previous Cochrane review, which concluded that provision of information alone (standard education, demonstration, advice, and information booklets) does not improve adherence or have long-term benefits.[22]

Following on from the use of audiovisual technology (DVD and videotape) used in articles included in this review, increasingly in recent years, the use of smart phone applications has been investigated for use in therapeutic interventions. Some authors suggest selective use of applications in conjunction with health professional intervention may increase adherence, participation, and effectiveness of therapy[23,24]; however, to date, research has focused on theoretical content and no experimental evidence yet exists to support this claim.

Behavioral approaches, however, showed promise in encouraging adults to self-manage chronic upper limb conditions. Feinberg[18] used learning principles, shared expectations, encouragement, and positive affective tone and behaviors by the therapist. This worked to address any dissatisfaction and assign responsibility to the patient while emphasizing a team approach by the involved health professionals. Hammond and Freeman[19] focused their intervention on key factors such as dedicating a significant portion of time to repetition and practicing the desired skills in small groups, providing feedback on performance, and using a range of options to allow participants to choose individually tailored solutions, including contracts, goal setting, and problem solving. In a follow-up of participants in their 2001 study, Hammond and Freeman found that, at 4 years, the joint protection group continued to have significantly better joint protection adherence than the control group.[25] Our positive findings for behavioral approaches are consistent with that the management of other chronic health conditions such as obesity[26] and dystonia.[27]

Methodological quality

The overall quality of the 8 studies was variable, with most studies scoring consistently low to moderate marks on the Cochrane Collaboration tool for assessing the risk of bias.[13]

Heterogeneity of patients and outcome measures

Variations in patient characteristics within and between the 8 studies may have influenced the treatment effects and was 1 factor which limited comparisons. Four studies focused on acute injuries, and 4 focused on chronic conditions. Only 1 study focused on improving treatment adherence in children, which was surprising given the challenges associated with managing acute injuries in this population.

Similarly, only 1 outcome measure–the number of participants either fully or partially adherent with exercise–enabled the pooling of results. There are few standardized and validated adherence measures used in hand therapy, and future tools should incorporate specific measures of participant achievement of agreed number exercises or activity sessions; agreed orthosis or device wear hours; agreed number of symptom self-management activities; and adherence to modified or restricted activities.

Strengths and limitations of the review

The strengths of the review include the specific inclusion criteria, the adherence to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses recommendations,[28] and a priori protocol publication on the PROSPERO Web site. Limitations include the small number of eligible trials, with considerable heterogeneity of patient populations and outcome measures used. Despite the lack of comparability of included studies, this review serves as a baseline on this topic.

Conclusion

Adherence to therapy has been shown to contribute to better outcomes in medical[4] and hand and upper limb conditions[7] and therefore an essential consideration for hand therapy intervention.

Behavioral approaches that encourage self-efficacy are likely to be useful in achieving treatment adherence in populations with chronic upper limb conditions. Hand therapists should consider

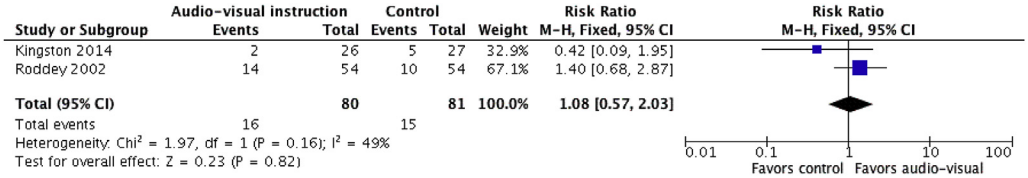

Fig. 4. Forest plot of comparison: audiovisual instruction vs written (control)—partial exercise adherence. CI = confidence interval.

utilizing learning principles; inclusion of dedicated time for skill acquisition and practice within therapy sessions; providing feedback and encouragement; and fostering self-efficacy through problem solving and goal setting in their practice.

There is insufficient evidence for other interventions aimed at improving adherence in acute upper limb injuries and conditions; however, patient preference, comfort, and consideration of the impact on daily living activities have previously been shown to be important.[7]

Further high-quality RCTs with reliable and valid measures of adherence, such as sensors embedded in orthoses[29] or the Exercise Adherence Rating Scale[30] are needed to assess the effectiveness of other interventions to improve treatment adherence, including the use of audiovisual technology to deliver exercise or other treatment instructions.

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Contributors: Dr O'Brien, Ms Cole, Mr Robinson, and Ms Romero were involved in designing the review and developing the methods. Ms Romero completed searches of all databases. Data were extracted by Ms Cole and Mr Robinson and checked by Dr O'Brien. Dr O'Brien completed the analyses, and Ms Cole and Dr O'Brien drafted the manuscript. All the authors read, edited, and approved the final manuscript.

Supplementary data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jht.2017.11.040.

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JHT Read for Credit
Quiz: # 605

Record your answers on the Return Answer Form found on the tear-out coupon at the back of this issue or to complete online and use a credit card, go to *JHTReadforCredit.com*. There is only one best answer for each question.

#1. The study design is
   a. RCTs
   b. a systematic review of the pertinent literature on the topic
   c. qualitative
   d. a retrospective cohort

#2. The author uses the term adherence as a synonym for
   a. diminished gliding
   b. obedience
   c. sticking tissues together
   d. compliance

#3. The authors intend to
   a. dispute the traditional wisdom concerning adherence
   b. provide a unique definition of the term adherence
   c. report on outcome measures when reporting on adherence
   d. propose a novel method of reporting on adherence

#4. The authors found support for_____ in improving patient adherence
   a. patient testing
   b. behavioral approaches
   c. recruiting the physicians' assistance
   d. citing cost factors

#5. The authors found very little data to support the thesis that orthotics or casts had a significant effect on patient adherence
   a. true
   b. false

When submitting to the HTCC for re-certification, please batch your JHT RFC certificates in groups of 3 or more to get full credit.

Appendix A. Medline search strategy

No.	Searches
1	hand injuries/ or finger injuries/ or arm injuries/ or forearm injuries/ or wrist injuries/ or Shoulder Injuries/
2	humeral fractures/ or radius fractures/ or colles' fracture/ or ulna fractures/ or monteggia's fracture/
3	shoulder dislocation/ or shoulder impingement syndrome/ or Dupuytren Contracture/
4	Elbow Tendinopathy/ or Tennis Elbow/ or Rotator Cuff Injuries/ or Hand Deformities, Acquired/
5	brachial plexus neuropathies/ or brachial plexus neuritis/
6	median neuropathy/ or carpal tunnel syndrome/ or radial neuropathy/ or ulnar neuropathies/ or cubital tunnel syndrome/ or ulnar nerve compression syndromes/
7	or/1-6
8	upper extremity/ or arm/ or axilla/ or elbow/ or forearm/ or hand/ or fingers/ or thumb/ or metacarpus/ or wrist/ or shoulder/
9	acromioclavicular joint/ or elbow joint/ or hand joints/ or carpal joints/ or carpometacarpal joints/ or finger joint/ or metacarpophalangeal joint/ or palmar plate/ or wrist joint/ or triangular fibrocartilage/ or shoulder joint/
10	"bones of upper extremity"/ or arm bones/ or humerus/ or humeral head/ or radius/ or ulna/ or olecranon process/ or clavicle/ or hand bones/ or carpal bones/ or capitate bone/ or hamate bone/ or lunate bone/ or pisiform bone/ or scaphoid bone/ or trapezium bone/ or trapezoid bone/ or triquetrum bone/ or finger phalanges/ or metacarpal bones/ or scapula/ or acromion/ or coracoid process/ or glenoid cavity/
11	deltoid muscle/ or pectoralis muscles/ or rotator cuff/
12	brachial plexus/ or median nerve/ or musculocutaneous nerve/ or radial nerve/ or ulnar nerve/
13	axillary artery/ or brachial artery/ or radial artery/ or ulnar artery/
14	or/8-13
15	exp "Wounds and Injuries"/
16	14 and 15
17	acromioclavicular joint/in, su or elbow joint/in, su or hand joints/in, su or carpal joints/in, su or carpometacarpal joints/in, su or finger joint/in, su or metacarpophalangeal joint/in, su or palmar plate/in, su or wrist joint/in, su or triangular fibrocartilage/in, su or shoulder joint/in, su
18	upper extremity/in, su or arm/in, su or axilla/in, su or elbow/in, su or forearm/in, su or hand/in, su or fingers/in, su or thumb/in, su or metacarpus/in, su or wrist/in, su or shoulder/in, su
19	"bones of upper extremity"/in, su or arm bones/in, su or humerus/in, su or humeral head/in, su or radius/in, su or ulna/in, su or olecranon process/in, su or clavicle/in, su or hand bones/in, su or carpal bones/in, su or capitate bone/in, su or hamate bone/in, su or lunate bone/in, su or pisiform bone/in, su or scaphoid bone/in, su or trapezium bone/in, su or trapezoid bone/in, su or triquetrum bone/in, su or finger phalanges/in, su or metacarpal bones/in, su or scapula/in, su or acromion/in, su or coracoid process/in, su or glenoid cavity/in, su
20	deltoid muscle/in, su or pectoralis muscles/in, su or rotator cuff/in, su
21	brachial plexus/in, su or median nerve/in, su or musculocutaneous nerve/in, su or radial nerve/in, su or ulnar nerve/in, su
22	axillary artery/in or brachial artery/in or radial artery/in or ulnar artery/in
23	or/17-22
24	((glenohumeral* or coracoid* or scapula* or suprascapula* or shoulder* or clavicle* or clavicular* or acromioclavicular* or glenoid* or supraglenoid* or infraglenoid* or infraspinous* or supraspinous* or acromion* or collarbone* or sternoclavicular* or costoclavicular* or conoid* or trapezoid* or coracoclavicular* or interclavicular* or coracoacromial* or acromial* or (upper limb* or upper extremit* or humerus or humeral or forearm* or arm or arms or radius or radial or ulna or elbow* or greater tubercle or lesser tubercle or intertubercular sulcus or intertubercular groove or surgical neck or deltoid tuberosity or radial groove or supraepicondyl* or supracondyl* or epicondyl* or transcondyl* or unicondyl* or intercondyl* or trochlea* or capitul* or capitel* or coronoid* or olecranon*) or (radioulnar or ulnar or styloid* or wrist* or carpal* or scaphoid* or lunate* or hand or hands or metacarpal* or phalan* or finger* or thumb* or metacarpus or digit or digits or triquetrum* or pisiform* or trapezium* or trapezoid* or capitate* or scaphotrapezial* or scaphoidlunate* or triquetrohamate* or lunatotriquetral* or capitohamate* or trapeziocapitate* or trapezocapitate* or lunotriquetrial or hamate* or palm* or anatomical snuffbox or interosseous or interossei or carpometacarpal*) or (pectoralis or serratus anterior or subclavius or scapulohumeral* or deltoid or teres major or rotator cuff or supraspinatus or infraspinatus or subscapularis or teres minor or trapezium or latissimus dorsi or levator scapulae or rhomboid) or (biceps brachii or coracobrachialis or brachialis or triceps brachii or flexor carpi ulnaris or palmaris longus or flexor carpi radialis or pronator teres or flexor digitorum superficialis or flexor digitorum profundus or flexor pollicis longus or pronator quadratus) or (brachoradialis or extensor carpi radialis or extensor digitorum or extensor digiti minimi or extensor carpi ulnaris or anconeus or supinator or abductor pollicis or extensor pollicis or extensor indicis proprius or opponens pollicis or thenar or hypothenar or flexor pollicis or opponens digiti or abductor digiti or flexor digiti or lumbrical* or palmar interossi or dorsal interossei or palmaris brevis or adductor pollicis) or (subacromial* or supraspinatus or subscapular* or coracohumeral* or transverse humeral* or coracoacromial* or radial collateral or ulnar collateral or collateral ligament* or checkrain ligament* or intratendinous bursa* or subtendinous bursa* or fibrocartilag*) or (radiocarpal* or radioulnar or metacarpophalangeal or interphalangeal or knuckle* or triquetrohamate* or ulnolunate or ulnotriquetral or ulnocapitate* or radioscaphocapitate* or radioscapholunate* or carpometacarpal or midcarpal or palmar fascia or palmar aponeurosis or fibrous digital or flexor retinaculum or transverse carpal or anterior annular or extensor retinaculum or intermetacarpal or oblique ligament* or dorsoradial or palmar plate* or volar plate* or flexor tendon* or extensor tendon*) or (brachial plexus or musculocutaneous nerve* or axillary nerve* or median nerve* or radial nerve* or ulnar nerve* or scapular nerve* or suprascapular nerve* or pectoral nerve* or interosseous nerve*) or (cubital fossa or brachioradialis or bicipital aponeurosis or biceps or carpal tunnel or carpal arch or radial fossa or axillary arter* or subscapular arter* or humeral arter* or radial arter* or ulnar arter* or palmar digital arter*) or (cephalic vein* or basilic vein* or brachial vein* or axillary vein* or cubital vein*)) adj3 (injur* or trauma* or lacerat* or fractur* or dislocat* or instabilit* or tear* or torn or ruptur* or repair* or reconstruct* or impinge* or inflammat* or tendinopath* or tendinit* or tendonit* or tenosynovit* or bursitis or entrapment* or damage* or deformit* or capsulit* or compression* or contractur* or isch?emi* or denervation* or lesion* or arthroplast* or arthroscop* or arthrodes* or arthropath* or arthrit* or neuropath* or palsy)).tw.
25	7 or 16 or 23 or 24
26	patient compliance/ or no-show patients/ or patient dropouts/ or treatment refusal/ or Health Behavior/ or Patient Participation/ or Attitude to Health/ or health education/ or patient education as topic/ or Physician-Patient Relations/ or Hospital-Patient Relations/ or Nurse-Patient Relations/ or Professional-Patient Relations/ or Refusal to Participate/
27	((Patient* or client* or consumer*) adj3 (cooperat* or co-operat* or adhere* or comply or complian* or nonadhere* or noncomplian* or noncooperat* or nonco-operat* or no-show* or nonattendan* or dropout* or drop-out* or refusal or continuance or discontinu* or acceptance* or nonacceptance* or involvement* or noninvolvement* or empower* or engage* or disengage* or participat* or nonparticipat* or persever* or nonpersever*or persist* or nonpersist* or willing* or unwilling* or conform* or nonconform* or non-observan* or nonconsisten* or nonobedien* or collaborat* or noncollaborat*)).tw.
28	((treatment* or therap* or program* or protocol* or regimen*) adj3 (adhere* or comply or complian* or nonadhere* or noncomplian* or no-show* or nonattendan* or dropout* or drop-out* or refusal or continue* or continuing or continuance or discontinu* or accept* or nonaccept* or participat* or nonparticipat* or persever* or nonpersever* or persist* or nonpersist* or unwilling* or conform* or nonconform* or uptake)).tw.
29	26 or 27 or 28
30	25 and 29
31	25 and 29

(*continued*)

No.	Searches
32	limit 31 to english language
33	exp animals/ not humans.sh.
34	32 not 33
35	(randomized controlled trial or controlled clinical trial or multicenter study).pt.
36	(random* or trial or placebo).tw. or clinical trial*.mp.
37	systematic review*.mp,pt.
38	(Cohort adj (study or studies or analysis)).mp.
39	((follow-up or followup or observational or prospective or retrospective or epidemiologic or cross sectional or case control or crossover or cross-over or longitudinal or intervention) adj (study or studies)).mp.
40	35 or 36 or 37 or 38 or 39
41	34 and 40