ISSN 0008-3194 (p)/ISSN 1715-6181 (e)/2015/349–362/$2.00/©JCCA 2015

The effectiveness of structured patient education for the management of musculoskeletal disorders and injuries of the extremities: a systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration

Kristi Randhawa, BHSc, MPH[1,2,5]
Pierre Côté, DC, PhD[1,3,4]
Douglas P Gross, BScPT, PhD[9]
Jessica J Wong, BSc, DC, FCCS(C)[1,2]
Hainan Yu, MBBS, MSc[1,2]
Deborah Sutton, BScOT, MEd, MSc[1,2]
Danielle Southerst, BScH, DC, FCCS(C)[1,5]
Sharanya Varatharajan, BSc, MSc[1,2,5]
Silvano Mior, DC, PhD[2,8]
Maja Stupar, DC, PhD[1,2,4]
Heather M Shearer, DC, MSc, FCCS(C)[1,2]
Gail M Lindsay, RN, PhD[1,4]
Craig Jacobs, BFA, DC, MSc, FCCS(C)[6,7]
Anne Taylor-Vaisey, MLS[1]

[1] UOIT-CMCC Centre for the Study of Disability Prevention and Rehabilitation, University of Ontario Institute of Technology (UOIT) and Canadian Memorial Chiropractic College (CMCC)
[2] Graduate Education and Research Programs, Canadian Memorial Chiropractic College
[3] Canada Research Chair in Disability Prevention and Rehabilitation, University of Ontario Institute of Technology
[4] Faculty of Health Sciences, University of Ontario Institute of Technology
[5] Division of Undergraduate Education, Canadian Memorial Chiropractic College
[6] Clinical Research Coordinator, UOIT-CMCC Centre for the Study of Disability Prevention and Rehabilitation
[7] Assistant Professor, Division of Clinical Education, Canadian Memorial Chiropractic College (CMCC)
[8] Adjunct Professor, Faculty of Health Sciences, UOIT
[9] Professor, Department of Physical Therapy, University of Alberta

Corresponding author:
Kristi Randhawa
UOIT-CMCC Centre for the Study of Disability Prevention and Rehabilitation,
6100 Leslie Street, Toronto, ON M2H 3J1, Canada;
Email: Kristi.randhawa@uoit.ca

Purpose: *To determine the effectiveness of structured patient education for the management of musculoskeletal disorders and injuries of the extremities.*

Methods: *We searched MEDLINE, EMBASE, CINAHL, PsycINFO, and the Cochrane Central Register of Controlled Trials from January 1, 1990 to March 14, 2015. Paired reviewers independently screened titles and abstracts for eligibility. The internal validity of studies was assessed using the Scottish Intercollegiate Guidelines Network (SIGN) criteria. Results from studies with a low risk of bias were synthesized using the best-evidence synthesis methodology.*

Results: *We identified two randomized trials with a low risk of bias. Our review suggests that: 1) multimodal care and corticosteroid injections lead to faster pain relief and improvement than reassurance and advice in the short-term and similar outcomes in the long-term for patients with persistent lateral epicondylitis; and 2) providing health education material alone may be less effective than multimodal care for the management of persistent patellofemoral pain syndrome.*

Conclusion: *Our systematic search of the literature demonstrates that little is known about the effectiveness of structured patient education for the management of musculoskeletal disorders and injuries of the extremities. Two studies suggest that when used alone, structured patient education may be less effective than other interventions used to manage persistent lateral epicondylitis and persistent patellofemoral syndrome.*

(JCCA. 2015; 59(4):349-362)

KEY WORDS: chiropractic, systematic review, patient education, injury, extremity, lateral epicondylitis, patellofemoral pain

Objectif: *D*éterminer *l'efficacité d'une* éducation *des patients structurée aux fins de la prise en charge des troubles musculo-squelettiques et des lésions des extrémités.*

Méthodes: *Nous avons consulté MEDLINE, EMBASE, CINAHL, PsycINFO et le Cochrane Central Register of Controlled Trials du 1er janvier* 1990 au 14 mars 2015 aux fins de *recherche. Les examinateurs appariés ont trié de façon indépendante les titres et* résumés *afin d'évaluer leur admissibilité. La validité interne des* études *a* été évaluée *à l'aide des critères du Scottish Intercollegiate Guidelines Network (SIGN). Les résultats des* études *présentant un faible risque de biais ont* été *synthétisés à l'aide de la méthodologie de la synthèse des meilleures données probantes.*

Résultats: *Nous avons identifié deux essais randomisés présentant un faible risque de biais. Notre examen suggère ce qui suit : 1) les soins multimodaux et les injections corticostéroïdes entraînent un soulagement de la douleur et une amélioration plus rapides que la rassurance et les conseils à court terme, et conduisent à des résultats similaires à long terme chez les patients souffrant d'épicondylite latérale persistante; et 2) fournir uniquement des documents d'éducation à la santé peut* être *moins efficace que les soins multimodaux pour la prise en charge du syndrome fémoro-rotulien douloureux persistant.*

Conclusion: *Nos recherches systématiques de la littérature démontrent que les connaissances au sujet de l'efficacité de l'éducation des patients structurée aux fins de la prise en charge des troubles musculo-squelettiques et des lésions des extrémités sont limitées. Deux* études *suggèrent que lorsqu'elle est utilisée seule, l'éducation des patients structurée peut* être *moins efficace que les autres interventions utilisées pour prendre en charge l'épicondylite latérale persistante et le syndrome fémoro-rotulien de durée variable.*

(JCCA. 2015; 59(4) : 349-362)

MOTS-CLÉS : chiropratique, examen systématique, éducation des patients, lésion, extrémité, épicondylite latérale, syndrome fémoro-rotulien douloureux

Introduction

Musculoskeletal disorders and injuries are a common source of pain in the upper and lower extremities. In the Netherlands, the point prevalence of musculoskeletal pain ranges from 5% for ankle pain to 21% for shoulder pain.[1] In the United States, 16% and 36% of all injuries presenting to emergency departments are sprains and/or strains of the upper and lower extremities respectively.[2,3] In Saskatchewan, 35.1% and 27.5% of individuals involved in motor vehicle collisions report upper and lower extremity pain respectively.[2]

Musculoskeletal disorders and injuries of the extremities are associated with a significant burden of disability for individuals, workplaces and health care systems. In Australia, individuals who report shoulder pain and/or stiffness have lower health-related quality of life and are more likely to report depressive symptoms than those without shoulder complaints.[4] In the United States, the median time away from work because of occupational injuries to the upper and lower extremities in 2013 were 10 and 12 days respectively.[5] In Ontario, Canada, leg and ankle injuries accounted for 18% of lost time claims in 2013, while shoulder injuries accounted for 6% of lost time claims among workers.[6] Furthermore, two thirds of Canadians with sprains or strains experience some level of disability and seek medical care.[7]

Clinicians commonly educate patients in a structured or unstructured way during a course of care to manage musculoskeletal disorders and injuries. Structured patient education involves standardized interventions delivered through pamphlets, books, videos, discussion with healthcare providers, or the internet.[8] Very little is known about the effectiveness of structured patient education for the management of musculoskeletal disorders and injuries of the extremities. A recent review on the effectiveness of structured patient education for the management of neck pain concluded that structured education alone cannot be expected to yield large benefits to patients with neck pain.[9]

The purpose of this systematic review was to determine the effectiveness of structured patient education compared to other interventions, placebo/sham interventions or no intervention in improving self-rated recovery, functional recovery (e.g., return to activities, work or school), or clinical outcomes (e.g., pain, health-related quality of life, depression) of patients with musculoskeletal disorders and injuries of the upper and lower extremities.

Methods

Registration

This review protocol was registered with the International Prospective Register of Systematic Reviews (PROSPERO) on April 9th, 2014 (CRD42014009287).

Eligibility Criteria

Population: Our review targeted studies of adults or children with musculoskeletal disorders and injuries of the upper and lower extremities. We excluded studies involving pathology (e.g., fractures, dislocations, infection, neoplasm, or systemic disease). We defined musculoskeletal disorders and injuries, based on the Centers for Disease Control and Prevention (CDC) definition, as grade I-II sprains or strains, nonspecific shoulder, elbow, wrist, hip, knee, ankle and/or foot pain, tendonitis, tendinopathy, tendinosis and other musculoskeletal disorders and injuries (including neuropathies) as informed by available evidence.[10] Studies of grade I-III ankle sprains and strains were considered if a grade specific analysis was conducted or if a trial included the same distribution of grade III injuries across intervention groups.

Intervention: We restricted our review to studies that tested the effectiveness of structured patient education. We defined structured patient education as a process of enabling individuals to make informed decisions about their personal health-related behaviour.[11] For the purpose of our review, we considered patient education interventions to be structured, standardized, and condition-specific. Therefore, we investigated structured patient education strategies that were delivered through pamphlets, books, videos, formal/structured discussion with healthcare providers, or the internet, where the education interventions focused on reassurance or advice on activation, exercise, expected pain and its mechanism, prognosis, stress-coping skills, workplace ergonomics, self-care strategies or general health. Because of its nature, structured patient education can be differentiated from the usual education that is routinely provided by clinicians during the course of clinical care. Our goal was to determine the effectiveness that can be specifically attributed to structured patient education; therefore, we excluded education interventions that were provided in multimodal programs of care that did not permit an assessment of the effect of structured patient education alone.

Table 1.
Study inclusion and exclusion criteria

Inclusion criteria	Exclusion criteria
• English language • Studies published between January 1st, 1990 and March 14th, 2015 • Study designs including: randomized controlled trials (RCTs), cohort studies, case-control studies • Inception cohort of at least 30 subjects per treatment arm for RCTs or 100 subjects per exposed group for cohort studies with musculoskeletal disorders or injuries of the upper and/or lower extremities	• Guidelines, letters, editorials, commentaries, unpublished manuscripts, dissertations, government reports, books and book chapters, conference proceedings, meeting abstracts, lectures and addresses, consensus development statements, or guideline statements • Cross-sectional studies, case reports, case series, qualitative studies, narrative reviews, systematic reviews, clinical practice guidelines, biomechanical studies, or laboratory studies • Cadaveric or animal studies • Studies on patients with severe injuries (e.g. grade III sprains/strains, fractures, dislocations, full ruptures, infections, malignancy, osteoarthritis, and systemic disease)

Comparison groups: We included studies that used other education interventions, placebo/sham intervention, wait list, no intervention or other conservative or invasive interventions.

Outcomes: To be eligible, studies had to include one of the following outcomes: 1) self-rated recovery; 2) functional recovery (e.g. disability, return to activities, work, or school); 3) clinical outcomes (e.g. pain, health-related quality of life, depression); 4) administrative data (e.g. time on benefits); or 5) adverse events.

Study characteristics: Study inclusion and exclusion criteria are listed in Table 1.

Information sources

We developed our search strategy with a health sciences librarian (Appendix 1). A second librarian reviewed the search strategy for completeness and accuracy using the Peer Review of Electronic Search Strategies (PRESS) Checklist.[12,13] We searched the following databases: MEDLINE, EMBASE, CINAHL (EBSCO), PsycINFO, and the Cochrane Central Register of Controlled Trials (Ovid). We searched all bibliographic databases from January 1st, 1990 to March 14th, 2015.

We first developed the search strategy in MEDLINE and subsequently adapted it to other bibliographic databases. The search terms included subject headings (e.g. MeSH for MEDLINE) specific to each database and free text words relevant to our research question and inclusion criteria.

Study Selection

We used a two-phase screening process to select eligible studies. In phase one, random pairs of independent reviewers screened titles and abstracts of citations to determine the eligibility of studies. Phase one screening resulted in studies being classified as relevant, possibly relevant, or irrelevant. In phase two, the same pairs of reviewers independently screened possibly relevant studies to determine eligibility. Reviewers met to resolve disagreements and reach consensus on the eligibility of studies. We involved a third reviewer if consensus could not be reached.

Assessment of Risk of Bias

Random pairs of independent reviewers critically appraised the internal validity of eligible studies using the Scottish Intercollegiate Guidelines Network (SIGN) criteria.[14] The SIGN criteria were used to qualitatively evaluate the presence and impact of selection bias, information bias, and confounding on the results of a study. We did not use a quantitative score or a cut-off to determine the internal validity of studies.[15] Rather, the SIGN criteria

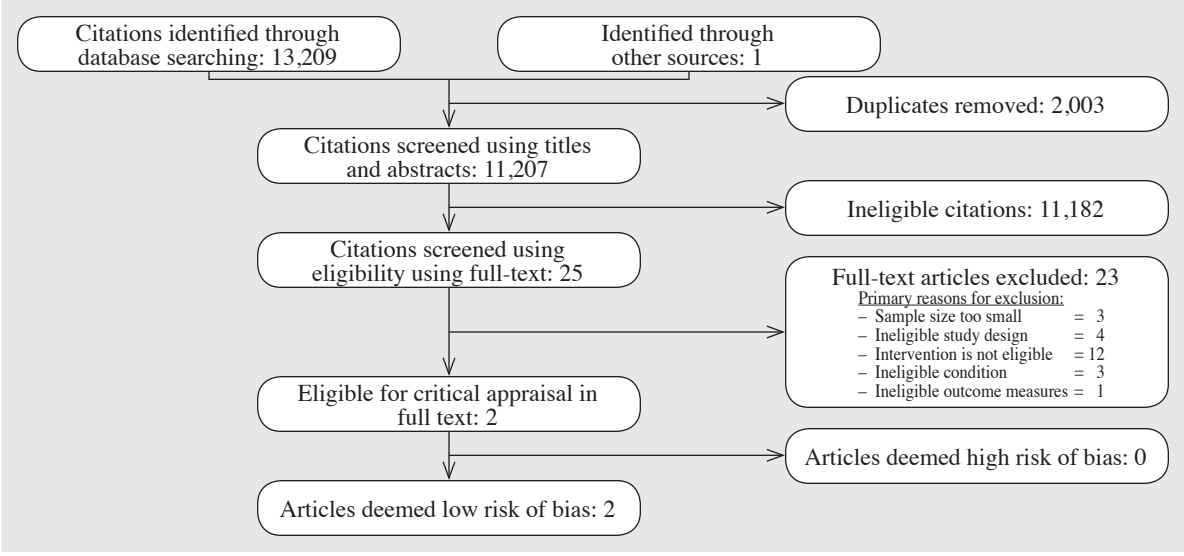

Figure 1:
Flow diagram of the number (n) of selected studies for effectiveness.

were used to assist reviewers to make an informed overall judgment on the internal validity of studies. This methodology has been previously described.[16-21]

Specifically, we critically appraised the following methodological aspects of an RCT: 1) clarity of the research question; 2) randomization method; 3) concealment of treatment allocation; 4) blinding of treatment and outcomes; 5) similarity of baseline characteristics between/among treatment arms; 6) co-intervention contamination; 7) validity and reliability of outcome measures; 8) follow-up rates; 9) analysis according to intention to treat principles; and 10) comparability of results across study sites (where applicable). Reviewers reached consensus through discussion. An independent third reviewer was used to resolve disagreements if consensus could not be reached. Following critical appraisal, studies with a low risk of bias were included in our synthesis.

Data Extraction and Synthesis of Results

The lead author extracted data from studies with a low risk of bias and built evidence tables (Table 3). A second reviewer independently checked the extracted data.

We performed a qualitative synthesis of findings from studies with a low risk of bias to develop evidence statements according to principles of best evidence synthesis.[22] An intervention was deemed to be effective if it was associated with statistically significant and clinically important improvements in outcomes.

Statistical Analysis

We computed agreements between reviewers for the screening of articles and reported the kappa statistic (k) and 95% confidence interval (CI).[23] We computed differences in mean changes between groups (with 95% CI) where data were available. The computation of CIs assumed an r=0.80 between baseline and follow-up outcome values.[24,25]

We stratified our results according to the type of disorder, duration [i.e. recent (≤ 3 months) versus persistent (>3 months)].

We used standardized cut-off values to determine if clinically important changes were reached in each trial for common outcome measures. These include a between-group difference of 10/100 mm or 10% difference

Table 2.
Summary of assessment of risk of bias for accepted randomized controlled trials (RCTs) based on the Scottish Intercollegiate Guidelines Network (SIGN) criteria[14].

Author, Year	Research Question	Random-ization	Conceal-ment	Blind-ing	Similarity at baseline	Similarity between arms	Outcome measure-ment	Percent drop-out*	Intent-ion to treat	Results comparable between sites
Bisset et al. [31]	Y	Y	Y	Y	Y	N	Y	6 Weeks: Multimodal Care: 5% Corticosteroid Injection: 0% Reassurance and advice: 10% 52 Weeks: Multimodal Care: 5% Corticosteroid Injection: 0% Reassurance and advice: 7%	Y	CS
Song et al. [30]	Y	CS	Y	Y	Y	Y	Y	LPHA: 2/29 = 6.9% LP: 3/30 = 10 % Control: 5/30 = 16.7%	Y	NA

*Percent drop-out includes drop-outs and loss to follow-up
Acronyms: Y: Yes, N: No, CS: Can't Say, NA: Not Applicable; LP: leg press; LPHA: leg press and hip adduction

on the Visual Analog Scale (VAS)[26], 2/10 points on the Numeric Rating Scale (NRS) [27], and 9/80 points on the Lower Extremity Functional Scale (LEFS).[28]

Reporting

The systematic review was organized and reported based on the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement.[29]

Results

Study Selection

We identified 13,210 citations of studies (which included one study identified in a related systematic review by our group).[30] We removed 2,003 duplicates and screened 11,207 citations (Figure 1). Of those, we found two relevant studies and both had a low risk of bias.[30,31] The primary reasons for exclusion in full text screening were: small sample size (RCTs n<30, cohort studies n<100), ineligible study design, inability to determine the effectiveness of patient education alone, ineligible condition, and ineligible outcome measures. We were unable to compute the inter-rater agreement for the screening of articles because only one relevant study was found through screening of the citations retrieved from the electronic search. The percentage agreement for the critical appraisal of articles was 100% (2/2 RCTs) based on admissible/inadmissible results.

Study Characteristics

We identified two RCTs with a low risk of bias; one study addressed the management of persistent lateral epicondylitis[31] and the other focused on persistent patellofemoral pain syndrome.[30] We did not identify studies that investigated the effectiveness of structured patient education for the management of nerve entrapment syndromes.

Risk of Bias within Studies

Both RCTs with a low risk of bias had: 1) adequate treatment randomization and concealment methods; 2) similar groups at baseline; 3) valid and reliable outcome measures; and 4) intention to treat analyses (Table 2). The study follow-up rates were greater than 80% in both studies.

Table 3.

Evidence table for accepted randomized controlled trials assessing the effectiveness of structured patient education for musculoskeletal disorders and injuries of the extremities.

Author(s), Year	Subjects and Setting; Number (n) Enrolled	Interventions; Number (n) of Subjects	Comparisons; Number (n) of Subjects	Follow-up	Outcomes	Key Findings
Bisset et al.,[31]	Participants (18-65 y.o.) from Brisbane, Australia. Case definition: lateral elbow pain with palpation of the lateral epicondyle, gripping, resisted wrist or second or third finger extension of >6 weeks duration. (n=198)	Reassurance and Advice: reassurance (ADL modifications, analgesic drugs, heat, cold, braces), educational booklet (disease process, self-management advice, ergonomics) (n=67)	Corticosteroid injection by a GP (1 ml 1% lidocaine with 10 mg triamcinolone acetonide in 1 ml); 1 injection at painful points and second injection after two weeks if necessary; advice to return gradually to normal activities; educational booklet (disease process, self-management advice, ergonomics) (n=65) Multimodal care by a PT (8 visits/6 weeks): elbow manipulation, exercise (supervised and home-based), self-manipulation educational booklet (disease process, self-management advice, ergonomics). (n=66)	6, 12, 26 and 52 weeks	Primary Outcome: Global improvement (6 point Likert Scale); success = "completely recovered" or "much improved"; recurrence ("successful" to "unsuccessful"); pain-free grip force (digital grip dynamometer, affected side/ unaffected side x 100) Secondary Outcome: pain severity (VAS 0-100 mm); elbow disability (Pain Free Function Questionnaire (PFFQ 0-100)); Sensorimotor function: SRT(ms); RT1(ms); RT2(ms); S1(cm/s); S2(cm/s) Adverse events.	Relative Risk Reduction (Reassurance and Advice vs. Multimodal Care):* Success 6 weeks: RR 0.38 (95% CI 0.24; 0.61) 12 weeks: RR 0.77 (95% CI 0.58; 1.02) 26 weeks: RR 1.08 (99% CI 0.88; 1.32) 52 weeks: RR 0.93 (95% CI 0.82; 1.07) Recurrence 6 weeks: RR 1.18 (95% CI 0.38; 3.69) Difference in Mean Change from Baseline (Reassurance and Advice – Multimodal care*): Pain-free Grip Force 6 weeks: –20.1 (99% CI –30.0; –10.3) 12 weeks: –9.4 (99% CI –20.9; 2.1) 26 weeks: –15.4 (99% CI –20.9, –9.9) 52 weeks: –4.3 (99% CI –16.2; 7.5) Pain Severity 6 weeks: –15.6 (99% CI –26.4; –4.7) 12 weeks: –11.2 (99% CI –24.1; 1.8) 26 weeks: –4.9 (99% CI –10.3, 0.5) 52 weeks –6.9 (99% CI –17.3; 3.6) PFFQ 6 weeks: –15.6 (99% CI –28.4; –2.8) 12 weeks: –17.2 (99% CI –31.9; –2.4) 26 weeks: –5.0 (99% CI –11.1, 1.1) 52 weeks: –11.0 (99% CI –24.0; 2.1) Relative Risk Reduction (Reassurance and Advice vs. Corticosteroid Injections):* Success 6 weeks: RR 0.30 (95% CI 0.19; 0.48) 12 weeks: RR 1.17(95% CI 0.82; 1.67) 26 weeks: RR 1.61 (95% CI 1.18; 2.19) 52 weeks: RR 1.23 (95% CI 1.01; 1.51) Recurrence 6 weeks: RR 0.12 (95% CI 0.06; 0.27) Difference in Mean Change from Baseline (Reassurance and Advice – Corticosteroid Injections):* Pain-free Grip Force 6 weeks: –36.4 (99% CI –46.3; –26.5) 12 weeks: 5.4 (99% CI –6.0; 16.7) 26 weeks: 19.6 (99% CI 6.2; 33.0) 52 weeks: 12.1 (99% CI –0.3; 23.6) Pain Severity 6 weeks: –31.3 (99% CI –42.2; –20.5) 12 weeks: 5.2 (99% CI –7.5; 17.8) 26 weeks: 11.4 (99% CI –0.1; 23.0) 52 weeks: 7.7 (99% CI 2.7; 18.0) PFFQ 6 weeks: –33.3 (99% CI –46.0; –20.5) 12 weeks: –2.5 (99% CI –16.8; 11.9) 26 weeks: 19.5 (99% CI 5.8; 33.1) 52 weeks: 11.5 (99% CI –1.5; 24.5) Sensorimotor Function No differences between groups in SRT, RT1, RT2, S1 or S2 at any follow-up point. Adverse Events Minor: pain following treatment, loss of skin pigment; subcutaneous tissue atrophy Multimodal Care: 10.6%; Corticosteroid Injection: 20.0%; Wait and see: 0.0%.

*recalculated data from study; Acronyms: CI – confidence interval; LP – leg press; LPHA – leg press and hip adduction; VAS – Visual Analog Scale; y.o – years old; VMO – vastus medialis oblique; RR: Relative Risk; PFFQ – Pain Free Function Questionnaire; RT1 – 1-choice reaction time; RT2 – 2-choice reaction time; S1 – 1-choice speed of movement; S2 – 2-choice speed of movement; SRT – Simple Reaction Time

Table 3. (continued)
Evidence table for accepted randomized controlled trials assessing the effectiveness of structured patient education for musculoskeletal disorders and injuries of the extremities.

Author(s), Year	Subjects and Setting; Number (n) Enrolled	Interventions; Number (n) of Subjects	Comparisons; Number (n) of Subjects	Follow-up	Outcomes	Key Findings
Song et al., 2009[30]	Patients (≤ 50 years) referred to kinesiology laboratory were enrolled. Case definition: at least 2 of the following positive signs: (1) patellar crepitus, (2) pain following isometric quadriceps femoris muscle contraction against suprapatellar resistance (Clarke's sign), (3) pain following compression of the patella against the femoral condyles (patellar grind test), (4) tenderness upon palpation of the posterior surface of the patella or surrounding structures, and (5) pain following resisted knee extension. (n=89)	Health education material regarding patellofemoral pain (n=30).	Leg press (LP) using an EN-Dynamic Track Machine. Patients unilaterally trained at 60% of 1-repetition maximum for 5 sets of 10 repetitions (3x/week for 8 weeks) with 15 minutes of hot pack applied to quadriceps femoris prior to exercise (n=30). Leg press and hip adduction (LPHA), same as leg press with addition of 50-N hip adduction force applied to the distal one third of the thigh (3x/week for 8 weeks) with 15 minutes of hot pack applied to quadriceps femoris prior to exercise (n=29).	8 weeks (post-intervention)	Worst pain (VAS 100mm) Functional evaluation (Lysholm scale 0-100) Measurement of vastus medialis oblique (VMO) muscle morphology-ultrasonography (HDI 5000)	Difference in mean change (Control-LP)*: Pain (100mm): –2.41 (95% CI –3.20, –1.62) Functional evaluation (Lysholm scale): -10.2 (95% CI –13.89, –6.51) VMO cross-sectional area (cm^2): -0.72 (95% CI –1.26, –0.18) VMO volume (cm^3): –1.01 (–1.74, –0.28) Results for LPHA vs. Control cannot be used due to low sample size in the LPHA group. Adverse Events: Not reported

*recalculated data from study; Acronyms: CI – confidence interval; LP – leg press; LPHA – leg press and hip adduction; VAS – Visual Analog Scale; y.o – years old; VMO – vastus medialis oblique; RR: Relative Risk; PFFQ – Pain Free Function Questionnaire; RT1 – 1-choice reaction time; RT2 – 2-choice reaction time; S1 – 1-choice speed of movement; S2 – 2-choice speed of movement; SRT – Simple Reaction Time

Summary of Evidence

Persistent Lateral Epicondylitis

Evidence from one RCT suggests that reassurance and advice by a physician is less effective, in the short-term, than multimodal care by a physical therapist or corticosteroid injection by a physician for persistent lateral epicondylitis (Table 3).[31] However, there are no differences in long-term outcomes between groups. Bisset et al. randomized participants to: 1) reassurance and advice on self-management (activity modification, analgesic drugs, heat, cold or braces as needed); 2) multimodal care (elbow manipulation, clinic and home based exercise) provided in eight sessions over six weeks; or 3) one corticosteroid injection of the painful elbow joint and advice to return to normal activities (a second injection was offered after two weeks if necessary). All participants received an information booklet covering the disease process, self-management, and ergonomics. Participants randomized to the reassurance and advice group were less likely to report self-perceived improvement than those in the multimodal care group [Relative Risk (RR) = 0.38 (99% CI 0.24; 0.61)] at six weeks (Table 3). There were statistically significant and clinically important differences in pain severity [mean change difference on VAS: 15.6/100mm (99% CI 4.7; 26.4)] favouring multimodal care over reassurance and advice at the six-week follow-up. Similarly, the authors reported statistically significant differences in pain-free grip at six weeks and elbow disability at six weeks and 12 weeks favouring multimodal care over reassurance and advice. The minimal clinically important differences (MCIDs) for pain-free grip strength and elbow disability are unknown. When compared to the corticosteroid group, participants randomized to reassurance and advice were less likely to report self-perceived improvement [RR 0.30 (95% CI 0.19; 0.48)] at the six week follow-up (Table 3). There were statistically significant and clinically important improvements in pain severity [mean change difference on VAS: 31.3/100mm (99% CI 20.5; 42.2)] favouring corticosteroid injections over reassurance and advice at the six-week follow-up. Similarly, the corticosteroid group reported statistically significant improvements in pain-free grip force and elbow disability at the six-week follow-up. However, those in the reassurance and advice group reported greater improvements compared to the corticosteroid group in pain-free grip strength and elbow disability at 26 weeks (Table 3). At 52 weeks, improvements in pain severity favoured the reassurance and advice group; however, these improvements were not clinically important.

Persistent Patellofemoral Pain Syndrome

Evidence from one RCT suggests that an exercise-based multimodal care program by a physical therapist may provide superior outcomes to health education for the management of persistent patellofemoral pain syndrome.[30] In their study, Song et al. randomized participants to: 1) multimodal care that included hot pack application to the quadriceps femoris, followed by leg press exercises, stretching and cold pack; 2) multimodal care plus hip adduction strengthening; or 3) health education material regarding patellofemoral pain (format not specified). Results from the multimodal care plus hip adduction arm are not presented due to the small sample size (n<30). Leg press exercises were carried out using an EN-Dynamic Track Machine (5 sets of 10 repetitions; 3 times/week; over 8 weeks) with 15 minutes of hot pack applied to the quadriceps femoris prior to exercise. The control group received health education material regarding patellofemoral pain (specific content not reported). Immediately following the eight week intervention, participants who received the multimodal intervention of leg press exercises combined with hot pack experienced statistically significant but not clinically important improvements in pain [mean change difference on VAS: 2.41/100mm (95% CI 1.62; 3.20)] compared to the patient education group (Table 3). Additionally, participants who received the multimodal care program had statistically significant improvement in function, vastus medialis oblique (VMO) cross-sectional area and VMO volume. The clinical importance of these differences is unclear. Although there were statistically significant differences in all outcome measures, there is marked uncertainty for the reported pain value. Specifically, the pain measurement scale (VAS 0-100 mm) described in the methodology and tables is incongruent, e.g. the value is very small, given that the primary complaint in patellofemoral pain syndrome would be anticipated to be pain. Extensive efforts were undertaken to contact the authors for clarification, but no response was received. Therefore, the results of this study should be interpreted with caution.

Adverse events

One of the two studies reported on adverse events.[31] Bisset et al. reported that 20% of participants experienced adverse events associated with the corticosteroid injection. In the same study, 10.6% of participants reported adverse events associated with multimodal care. The most common adverse event was pain after treatment (19/20 events). No adverse events were reported by those randomized to reassurance and advice.[31]

Discussion

Although structured patient education is commonly recommended for the management of musculoskeletal disorders and injuries, our review demonstrates that very little is known about its effectiveness. We found two RCTs with a low risk of bias that provide evidence on the effectiveness of structured patient education for the management of musculoskeletal injuries in the upper and lower extremities. We found that, in the short-term, structured patient education is less effective, than multimodal care or corticosteroid injection for the management of persistent lateral epicondylitis. We also found evidence that an exercise-based multimodal program of care may be superior to structured patient education for persistent patellofemoral syndrome immediately post-intervention. However, the clinical importance of this result is unknown. We found no admissible studies to inform the use of patient education for the management of musculoskeletal disorders and injuries of other extremities.

Our review reached similar conclusions on structured patient education as the previous review on the effectiveness of structured patient education for the management of neck pain. Yu et al. recently reported that structured patient education alone may be less effective than other non-invasive interventions (i.e. physiotherapy, supervised exercises and massage) in improving pain, functional recovery and clinical outcomes.[9] However, their review also found no evidence to suggest that one method of delivering an education intervention (i.e. oral versus written) is more effective than the other.[9] We did not find any studies with a low risk of bias comparing one form of structured patient education to another.

Our review has important clinical implications. Although it suggests that structured patient education may not be effective on its own for the management of extremity injuries, it does not suggest that clinicians should abandon educating patients. Educating patients about their condition, prognosis and appropriate treatment is always indicated and necessary when providing clinical care. Furthermore, in the study by Bisset et al., multimodal care that included an education booklet (disease

process, self-management, ergonomics) along with elbow manipulation, exercise (supervised and home-based), and self-manipulation was found to be statistically and clinically more important than education alone for persistent lateral epicondylitis.[31] Another systematic review by Sutton et al., suggested that multimodal care that includes manual therapy, education and exercise may benefit patients with grades I and II whiplash associated disorders and neck pain and associated disorders.[32] Therefore, our review suggests that education should not be used as a standalone intervention, but may be provided in combination with other effective interventions for musculoskeletal disorders and injuries of the extremities.

Our review has several strengths. First, we implemented a comprehensive and rigorous search strategy that was reviewed by a second librarian to help minimize errors. Second, we defined clear inclusion and exclusion criteria for the selection of relevant studies. Third, we used trained pairs of independent reviewers to screen and critically appraise the literature to minimize error and bias. Fourth, the SIGN criteria were used to standardize the critical appraisal process and to inform our scientific judgment. Lastly, our conclusions were based on a best-evidence synthesis, which involves excluding studies of low quality to minimize the risk of bias.

Our review also has limitations. First, we limited our search to studies published in the English language, which may have excluded some relevant studies. However, this is an unlikely source of bias as the majority of trials are published in English. The sole inclusion of trials published in English has not previously led to biased results.[33-36] Secondly, the critical appraisal process entails scientific judgment that may differ between reviewers. This potential bias was minimized by training reviewers to utilize a standardized critical appraisal tool and by using a consensus process. Lastly, we chose to exclude grey literature and unpublished trials because there are no systematic methods to search for this literature and these articles are often not peer reviewed.

Conclusion

Our systematic review demonstrates that very little is known about the effectiveness of structured patient education for the management of musculoskeletal disorders and injuries in the upper or lower extremities. For persistent lateral epicondylitis, the evidence suggests that reassurance and advice is associated with worse short-term outcomes than multimodal care or corticosteroid injections; however, the long-term outcomes are similar between interventions. Moreover, the evidence suggests that health education is less effective than strengthening exercises and hot packs in the short-term management of persistent patellofemoral syndrome. The effectiveness of structured patient education for musculoskeletal disorders and injuries in other extremities needs to be explored. Future research must have a low risk of bias and focus on specific forms of structured patient education for upper and lower extremities. Until further evidence indicates otherwise, it seems clinically reasonable that patient education should not be used as a standalone intervention, but rather in combination with other effective interventions for musculoskeletal disorders and injuries of the extremities.

Acknowledgements

This study was funded by the Ontario Ministry of Finance and the Financial Services Commission of Ontario (RFP No.: OSS_00267175). The funding agency was not involved in the collection of data, data analysis, interpretation of the data, or drafting of the manuscript. This research was undertaken, in part, thanks to funding from the Canada Research Chairs program.

The authors acknowledge the invaluable contributions to this review from: Angela Verven, Carlo Ammendolia, David Cassidy, John Stapleton, Linda Carroll, Margareta Nordin, Michel Lacerte, Mike Paulden, Murray Krahn, Patrick Loisel, Leslie Verville, Robert Brison, Shawn Marshall, and Roger Salhany. The authors also thank Trish Johns-Wilson at the University of Ontario Institute of Technology for her review of the search strategy.

References

1. Picavet HS, Schouten JS. Musculoskeletal pain in the Netherlands: prevalences, consequences and risk groups, the DMC(3)-study. Pain. 2003;102(1-2):167-178.
2. Lambers K, Ootes D, Ring D. Incidence of patients with lower extremity injuries presenting to US emergency departments by anatomic region, disease category, and age. Clin Orthop Rel Research. 2012; 470(1):284-290.
3. Ootes D, Lambers KT, Ring DC. The epidemiology of upper extremity injuries presenting to the emergency department in the United States. Hand. 2012; 7(1):18-22.
4. Hill CL, Gill TK, Shanahan EM, Taylor AW. Prevalence and correlates of shoulder pain and stiffness in a

population-based study: the North West Adelaide Health Study. Int J Rheum Dis. 2010; 13(3):215-222.
5. Bureau of Labor Statistics USDoL. Table 5. Number, incidence rate, and median days away from work for nonfatal occupational injuries and illnesses involving days away from work by injury or illness characteristics and ownership, 2012. Economic News Release 2012; http://www.bls.gov/news.release/osh2.t05.htm. Accessed August 24, 2014, 2014.
6. Board WSI. By the Numbers: 2013 WSIB Statistical Report Schedule 2. 2014.
7. Mo F, Neutel IC, Morrison H, Hopkins D, Da Silva C, Jiang Y. A cohort study for the impact of activity-limiting injuries based on the Canadian National Population Health Survey 1994-2006. BMJ Ppen. 2013;3(3).
8. Gross A, Forget M, St George K, et al. Patient education for neck pain. Cochrane Database System Rev. 2012; 3:Cd005106.
9. Yu H, Cote P, Southerst D, et al. Does structured patient education improve the recovery and clinical outcomes of patients with neck pain? A systematic review from the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. Spine J. Apr 4 2014.
10. Prevention CfDCa. NIOSH Program Portfolio. Musculoskeletal Disorders. 2015; http://www.cdc.gov/niosh/programs/msd/. Accessed March 19, 2015.
11. Bellamy R. An introduction to patient education: theory and practice. Med Teach. 2004; 26(4):359-365.
12. McGowan J, Sampson M, C L. An Evidence Based Checklist for the Peer Review of Electronic Search Strategies (PRESS EBC). Evid Based Libr Inform Pract. 2010; 5(1):149-154.
13. Sampson M, McGowan J, Cogo E, Grimshaw J, Moher D, Lefebvre C. An evidence-based practice guideline for the peer review of electronic search strategies. J. Clin. Epidemiol. 2009; 62(9):944-952.
14. Harbour R, Miller J. A new system for grading recommendations in evidence based guidelines. BMJ. 2001;323(7308):334-336.
15. van der Velde G, van Tulder M, Cote P, et al. The sensitivity of review results to methods used to appraise and incorporate trial quality into data synthesis. Spine. 2007; 32(7):796-806.
16. Carroll LJ, Cassidy JD, Peloso PM, Garritty C, Giles-Smith L. Systematic search and review procedures: results of the WHO Collaborating Centre Task Force on Mild Traumatic Brain Injury. J Rehab Med. 2004; 43(Suppl):11-14.
17. Cote P, Cassidy JD, Carroll L, Frank JW, Bombardier C. A systematic review of the prognosis of acute whiplash and a new conceptual framework to synthesize the literature. Spine. 2001; 26(19):E445-458.
18. Carroll LJ, Cassidy JD, Peloso PM, et al. Methods for the best evidence synthesis on neck pain and its associated disorders: the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. J Manip Physiol Ther. 2009; 32(2 Suppl):S39-45.
19. Hayden JA, Cote P, Bombardier C. Evaluation of the quality of prognosis studies in systematic reviews. Ann Intern Med. 2006; 144(6):427-437.
20. Hayden JA, van der Windt DA, Cartwright JL, Cote P, Bombardier C. Assessing bias in studies of prognostic factors. Ann Intern Med. 2013; 158(4):280-286.
21. Spitzer WO, Skovron ML, Salmi LR, et al. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining "whiplash" and its management. Spine. 1995; 20(8 Suppl):1S-73S.
22. Slavin RE. Best evidence synthesis: an intelligent alternative to meta-analysis. J Clin Epidemiol. 1995; 48(1):9-18.
23. Viera AJ, Garrett JM. Understanding interobserver agreement: the kappa statistic. Fam Med. 2005;37(5):360-363.
24. Abrams KR, Gillies CL, Lambert PC. Meta-analysis of heterogeneously reported trials assessing change from baseline. Stats Med. 2005; 24(24):3823-3844.
25. Follmann D, Elliott P, Suh I, Cutler J. Variance imputation for overviews of clinical trials with continuous response. J Clin Epidemiol. 1992; 45(7):769-773.
26. Stauffer ME, Taylor SD, Watson DJ, Peloso PM, Morrison A. Definition of nonresponse to analgesic treatment of arthritic pain: an analytical literature review of the smallest detectable difference, the minimal detectable change, and the minimal clinically important difference on the pain visual analog scale. Intl J Inflamm. 2011; 2011:231926.
27. Carroll LJ, Jones DC, Ozegovic D, Cassidy JD. How well are you recovering? The association between a simple question about recovery and patient reports of pain intensity and pain disability in whiplash-associated disorders. Disabil Rehabil. 2012; 34(1):45-52.
28. Binkley JM, Stratford PW, Lott SA, Riddle DL. The Lower Extremity Functional Scale (LEFS): scale development, measurement properties, and clinical application. North American Orthopaedic Rehabilitation Research Network. Phys Ther. 1999; 79(4):371-383.
29. Moher D, Liberati A, Tetzlaff J, Altman DG. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. BMJ. 2009; 339:b2535.
30. Song CY, Lin YF, Wei TC, Lin DH, Yen TY, Jan MH. Surplus value of hip adduction in leg-press exercise in patients with patellofemoral pain syndrome: a randomized controlled trial. Phys Ther. 2009; 89(5):409-418.
31. Bisset L, Beller E, Jull G, Brooks P, Darnell R, Vicenzino B. Mobilisation with movement and exercise, corticosteroid injection, or wait and see for tennis elbow: randomised trial. BMJ. 2006; 333(7575):939.
32. Sutton DA, Cote P, Wong JJ, et al. Is multimodal care

effective for the management of patients with whiplash-associated disorders or neck pain and associated disorders? A systematic review by the Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration. Spine J. Jul 8 2014.
33. Moher D, Pham B, Lawson ML, Klassen TP. The inclusion of reports of randomised trials published in languages other than English in systematic reviews. Health Technol Assess. 2003; 7(41):1-90.
34. Moher D, Fortin P, Jadad AR, Jüni P, Klassen T, Le Lorier J, et al. Completeness of reporting of trials published in languages other than English: implications for conduct and reporting of systematic reviews. Lancet. 1996; 347(8998):363-366.
35. Morrison A, Polisena J, Husereau D, Moulton K, Clark M, Fiander M, et al. The effect of English-language restriction on systematic review-based meta-analyses: a systematic review of empirical studies. Intl J Technol Assess Health Care. 2012; 28(2):138-144.
36. Sutton AJ, Duval SJ, Tweedie RL, Abrams, KR, Jones DR. Empirical assessment of effect of publication bias on meta-analyses. BMJ. 2000; 320(7249):1574-1577.

Appendix 1:
Search Strategy –
search terms for musculoskeletal disorders and injuries of the extremities and structured patient education.

1. exp Upper Extremity/
2. Shoulder Pain/
3. exp "Sprains and Strains"/
4. exp Cumulative Trauma Disorders/
5. exp Median Neuropathy/
6. Shoulder Impingement Syndrome/
7. exp Arm Injuries/
8. exp Hand Injuries/
9. Rotator Cuff/in [Injuries]
10. exp Tendinopathy/
11. Radial Neuropathy/
12. exp Ulnar Neuropathies/
13. exp Brachial Plexus/
14. Bursitis/
15. Thoracic Outlet Syndrome/
16. carpal tunnel syndrome.ab,ti.
17. (medial adj (epicondylitis or epicondylosis or epicondylopathy)).ab,ti.
18. (lateral adj (epicondylitis or epicondylosis or epicondylopathy)).ab,ti.
19. (shoulder* and (sprain* or strain*)).ab,ti.
20. (forearm* and (sprain* or strain*)).ab,ti.
21. (arm* and (sprain* or strain*)).ab,ti.
22. (wrist* and (sprain* or strain*)).ab,ti.
23. (hand* and (sprain* or strain*)).ab,ti.
24. tennis elbow.ab,ti.
25. (forearm and (injur* or pain)).ab,ti.
26. (wrist and (injur* or pain)).ab,ti.
27. peritendinitis.ab,ti.
28. (rotator cuff and (injur* or disorder*)).ab,ti.
29. (median adj neuropath*).ab,ti.
30. (radial adj neuropath*).ab,ti.
31. "De Quervain's tenosynovit*".ab,ti.
32. (shoulder and (tendonitis or impingement or capsulitis)).ab,ti.
33. frozen shoulder.ab,ti.
34. "thoracic outlet syndrome*".ab,ti.
35. brachial plexus.ab,ti.
36. bursitis.ab,ti.
37. "shoulder impingement syndrome*".ab,ti.
38. "upper extremit* injur*".ab,ti.
39. ((radial or ulnar) adj neuropath*).ab,ti.
40. (hand* and (injur* or pain)).ab,ti.
41. (arm* and (injur* or pain)).ab,ti.
42. (forearm* and (injur* or pain)).ab,ti.
43. (wrist* and (injur* or pain)).ab,ti.
44. (shoulder* and (injur* or pain)).ab,ti.
45. "cumulative trauma disorder*".ab,ti.
46. "cubital tunnel syndrome*".ab,ti.
47. "overuse syndrome*".ab,ti.
48. (repetit* and (strain* or sprain* or injur* or disorder*)).ab,ti.
49. or/1-48
50. exp Lower Extremity/
51. exp Hip Injuries/
52. exp Leg Injuries/
53. exp Knee Injuries/
54. exp Foot/
55. exp Toes/in [Injuries]
56. exp Knee Joint/
57. exp Foot Bones/
58. Anterior Cruciate Ligament/
59. Posterior Cruciate Ligament/
60. exp Collateral Ligaments/
61. Ankle Injuries/
62. Ankle Joint/
63. Ankle/
64. Lateral Ligament, Ankle/in [Injuries]
65. Fasciitis, Plantar/
66. (lower adj3 (extremit* or limb* or injur*)).ab,ti.
67. (ankle* and (sprain* or strain* or injur*)).ab,ti.
68. ((talofibular or calcaneofibular or calcaneotibial or tibio*) and (sprain* or strain* or injur*)).ab,ti.
69. (deltoid and ankle*).ab,ti.
70. (fibularis and strain*).ab,ti.
71. ((peroneal or peroneus) and strain*).ab,ti.
72. (tibialis and strain* and (anterior or posterior)).ab,ti.
73. (band syndrome and (illiotibial or IT)).ab,ti.
74. achilles.ab,ti.
75. (ACL or LCL or MCL or PCL).ab,ti.
76. "adductor muscle*".ab,ti.
77. "collateral ligament*".ab,ti.
78. gastrocnemius.ab,ti.

79. (gluteus or gluteal).ab,ti.
80. "hamstring*".ab,ti.
81. "hip flexor*".ab,ti.
82. "hoffa* syndrome".ab,ti.
83. iliofemoral.ab,ti.
84. impingement.ab,ti.
85. (buttock* and (injur* or pain*)).ab,ti.
86. (foot and (injur* or pain*)).ab,ti.
87. (hip* and (injur* or pain*)).ab,ti.
88. (knee* and (injur* or pain*)).ab,ti.
89. (leg* and (injur* or pain*)).ab,ti.
90. (thigh* and (injur* or pain*)).ab,ti.
91. (toe* and (injur* or pain* or turf)).ab,ti.
92. ischiofemoral.ab,ti.
93. "metatars*".ab,ti.
94. "patellofemoral pain syndrome*".ab,ti.
95. "patellar tendon*".ab,ti.
96. popliteus.ab,ti.
97. pubofemoral.ab,ti.
98. "quadricep*".ab,ti.
99. soleus.ab,ti.
100. talocrural.ab,ti.
101. "tarsal*".ab,ti.
102. tendinosis.ab,ti.
103. tendinopathy.ab,ti.
104. plantar fasciitis.ab,ti.
105. tibialis.ab,ti.
106. or/50-105
107. 49 or 106
108. exp Professional-Patient Relations/
109. exp Patient Education as Topic/
110. exp Patient Compliance/
111. exp Patient Participation/
112. exp Self Care/
113. Program Evaluation/
114. exp Health Knowledge, Attitudes, Practice/
115. Learning/
116. exp Videotape Recording/
117. Communication/
118. exp Internet/
119. exp Cognitive Therapy/
120. (patient* adj4 (educat* or inform* or learn* or teach* or knowledge or advice or advise*)).ab,ti.
121. (doctor* patient* adj4 (communicat* or educat* or relations* or interact*)).ab,ti.
122. (physician* patient* adj4 (communicat* or educat* or relations* or interact*)).ab,ti.
123. (nurse* patient* adj4 (communicat* or educat* or relations* or interact*)).ab,ti.
124. (educat* adj4 (consumer* or health)).ab,ti.
125. (email* or e-mail* or pamphlet* or book* or neck book* or neck school* or internet or facebook or twitter or youtube or linkedin or social media or advise or advice or advised).ab,ti.
126. ((cognitive or behavi*) adj3 (therap* or treatment*)).ab,ti.
127. "small adj3 group*".ab,ti.
128. (group* adj3 (learn* or teach*)).ab,ti.
129. "self manage*".ab,ti.
130. (brief adj2 intervention).ab,ti.
131. SBIRT.ab,ti.
132. or/108-131
133. Randomized Controlled Trials as Topic/
134. Controlled Clinical Trials as Topic/
135. Clinical Trials as Topic/
136. exp Case-Control Studies/
137. exp Cohort Studies/
138. Double-Blind Method/
139. Single-Blind Method/
140. Placebos/
141. randomized controlled trial.pt.
142. controlled clinical trial.pt.
143. comparative study.pt.
144. (meta analys* or meta-analys* or metaanalys*).ab,ti.
145. (cohort and (study or studies or analys*)).ab,ti.
146. (random* and (control* or clinical or allocat*)).ab,ti.
147. (case adj control*).ab,ti.
148. ((double or single) and blind*).ab,ti.
149. "placebo*".ab,ti.
150. (comparative and (study or studies)).ab,ti.
151. (case adj control*).ab,ti.
152. (meta analys* or meta-analys* or metaanalys*).ab,ti.
153. or/133-152
154. 107 and 132 and 153
155. limit 154 to (english language and humans and yr="1990 – Current")