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Abstract

Background. Clinical practice guidelines for non-specific low back pain do not recommend the use of non-rigid lumbar supports (NRLSs) despite the publication of several positive randomized controlled studies.

Objective. We conducted a systematic review with meta-analysis to assess the efficacy of NRLSs in the treatment and prevention of non-specific low back pain.

Methods. We searched for reports of randomized controlled trials in PubMed, Cochrane Library, EMBASE, Science Direct and Pedro databases. Data were analyzed by disease stage (acute, subacute, and chronic) and type of prevention (primary and secondary). The analysis of methodological quality involved the Physiotherapy Evidence Database (PEDro) scale.

Results. Of the 1581 records retrieved, only 4 full-text articles were included, with 777 patients: 378 in the NRLS group, and 348 in the control group. NRLSs conferred greater amelioration of disability (effect size -0.54, 95% CI -0.90; -0.17) and pain (-0.29, -0.46; -0.12) than standard management. Insufficient data prevented a comparison of the efficiency for acute, subacute and recurrent low back pain as well as meta-regression of responder phenotypes (sociodemographic and other patient characteristics).

Conclusion. We demonstrated the overall efficacy of NRLSs for both disability and pain. However, further studies are needed to assess which patients can benefit the most from lumbar supports based on patient phenotype and the characteristics of low back pain.

PROSPERO (CRD42018109855).

Keywords. low back pain, acute, chronic, subacute, lumbar support, meta-analysis, prevention.

Introduction

Low back pain (LBP) is a worldwide frequent health symptom [1]. Overall, 60% to 90% of the populations in developing countries have already experienced an episode of acute LBP. LBP is the leading cause of activity limitation and sick leave throughout the world [2,3].

Non-specific LBP (NSLBP) is the most frequent cause of LBP. NSLBP is most often classified according to duration and whether it is acute (< 4 weeks of progression), subacute (4 weeks to 3 months) and chronic (> 3 months of progression) [4]. First episodes of LBP are frequently without consequences, and complete recovery at 1 year ranges from 54% to 90% of cases [5]. However, non-recovering patients represent the largest part of the overall cost of LBP [6].

Management of NSLBP varies by duration of symptoms. For acute and subacute LBP, the aim is mainly to decrease and control the pain in order to recover and return to occupational activities. For chronic LBP, management is more complex due to psychosocial factors linked to chronic pain development [4,7].

Whatever the duration of the LBP, the management must associate pharmacological and non-pharmacological approaches. Pharmacological management is based on paracetamol, non-steroidal anti-inflammatory drugs, muscle relaxants (as second-line drugs only because of the side effects), and weak opioids [8]. The wide range of non-pharmacological treatments includes multidisciplinary management, physical exercises, and psychological support [9]. Lumbar supports can be proposed for treating and preventing NSLBP, but despite frequent prescription, consensus is lacking on the supports [10,11].

Lumbar supports are designated as orthoses, belts or corsets. To clarify the definition, we choose the term non-rigid lumbar support (NRLS), an adjustable elastic belt with back reinforcement that sustains or maintains the lumbar segment. These supports are serial

manufactured with standard sizes. This definition eliminates fully rigid corsets or simple abdominal belts.

The mechanism of action of lumbar supports depends on its stiffness, and we only discuss NRLSs here. For the biomechanical aspect, the NLRS acts by stiffening the lumbar spine as it increases abdominal pressure and reduces intervertebral disc compression [12,13]. Lumbar mobility is reduced for rotation and inclination movements but not sagittal movements. It improves postural control [14] but not proprioception [15]. The supports have limited impact on trunk muscles, with no action on reducing energetic expenditure and no reduction in local muscular activity associated with a lack of trunk muscle strength loss [16]. Some effects on cardiorespiratory and digestive functions are reported and could be considered before prescription, especially for the highest and more rigid lumbar supports. Compression of the abdominal cavity might raise blood pressure and reduce venous return [17]. Moreover, modifications of ventilatory mechanics such as an increase in respiratory rate or a decrease in vital capacity were reported when lifting loads [18]. No contraindications have been highlighted. These effects are still investigated and still debatable [19].

Prescription of an NRLS is not systematic by all physicians and physiotherapists because of the lack of practice guidelines or specific education on this topic. Management variations among countries and prescription of lumbar supports still vary greatly [20].

The literature contains many articles concerning treatment and prevention of NSLBP; the articles highlight the importance of non-pharmacologic therapy as a first choice, but overall we have only a moderate level of evidence for the non-recommendation of NRLSs [21-23]. The European recommendations [10] do not suggest lumbar supports for treating chronic LBP. The 2016 NICE recommendations do not advise the use of belts or corsets for managing LBP with or without sciatica [21]**.** For French recommendations, lumbar supports can be used for a short time without any evidence [22].

The literature is controversial concerning the prescription of NRLSs. The 2008 Cochrane review, updated in 2011, included 15 studies (7 for preventive interventions and 8 for treatment interventions) on the efficacy of lumbar supports in NSLBP [23]. According to the results, NRLSs are considered no more effective than no intervention for treating or preventing NSLBP. According to the authors, whether NRLSs are more effective than no or other interventions in treating LBP is unclear. Moreover, this Cochrane review did not focus on LBP duration regarding the effect of lumbar supports, despite difference in management of acute, subacute and chronic LBP.

Thus, we conducted a systematic review with meta-analysis to evaluate the effectiveness of NRLSs on disability and pain in treating and preventing NSLBP. A secondary aim was to describe the differences by NSLBP duration and to characterize the clinical and psychosocial phenotypes of patients who respond well to wearing lumbar supports.

Methods

Our methodological strategy followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines [24]. The literature review and meta-analysis were registered at PROSPERO (CRD42018109855).

Literature search

We conducted a systematic review of articles in the databases PubMed, Cochrane library, EMBASE, Science Direct and Pedro from January 2017 to March 2020. The search strategy included the keywords “low back pain”; “lumbar orthosis”; “lumbar belt”; “back support”; “lumbar support”; “lumbar brace”. We focused on studies that explored the efficiency of NRLSs in treating and preventing NSLBP, with disability and pain as main outcomes and with no time limit.

The search strategy is presented in the Appendix. We first selected articles by reading the titles. Duplicates were removed. We then read all titles and abstracts to screen articles according to the following criteria and assessed the eligibility of the remaining articles by reading the full text.

Selection criteria

We retained articles with the following criteria: written in English or French; recommendations from learned societies related to LBP; and trials about the efficiency of NRLS assessed with disability and pain as the outcomes in adult populations (age 18 to 65 years) for treatment and prevention. Participants with acute, subacute or chronic LBP were included in treatment studies. Participants without pain or recurrent pain were included in prevention studies. For prevention trials, lumbar supports had to be compared to the usual prevention. For treatment trials, NRLS had to be compared to usual care. We excluded articles that did not consider disability assessment and studies that assessed rigid lumbar belts, corsets or all other supports, except for NRLSs. Also, data on secondary forms of LBP, such as inflammatory disease, infection, cancer, osteoporosis or post-operative management were excluded.

Data extraction

The research was performed independently with the help of a specialized documentarian (NPD) to limit bias. One author (PG) conducted all literature searches and collated abstracts. Two authors (PG and CL) independently reviewed the abstracts and decided on the suitability of the articles for inclusion, with discussion with a third author (EC) if needed to achieve consensus. All authors then reviewed the eligible articles.

Only articles of randomized controlled trials (RCTs) in which wearing a NRLS was compared to conventional management and that measured disability and pain outcomes were retained for the meta-analysis. For all studies with available data, we extracted sample size, means, and standard deviations for each treatment group, at each time point reported. If data were not available, we contacted the authors to obtain missing data.

Assessment of methodological quality

The assessment of methodological quality was performed by 2 independent readers (PG, CL) by using the Physiotherapy Evidence Database (PEDro) scale [25]. This scale has 11 indicators to identify major risks of bias. Each point is scored. If mentioned and included, the point is given and noted as yes. According to the PEDro guidelines, the first point is not considered in the final score. A score out of 10 is given for each trial.

Statistical considerations

After extraction, data were compiled by software designed specifically for meta-analyses (Comprehensive Meta-Analysis v2; Biostat, Englewood, NJ). For descriptive analyses, data are presented as means (SD) or median (interquartile range), depending on the statistical distribution. Because outcomes were continuous (i.e., disability evaluated by Oswestry Disability Index and Roland Morris Disability Questionnaire and pain by a visual analog scale), the pooled standardized mean difference (SMD) was calculated with a random-effects model (DerSimonian and Laird approach) that accounted for the true variation in effects occurring among studies and for random errors within a single study. In other words, to address the non-independence of data due to study effect, random-effects models that assumed between- and within-study variability were used rather than fixed-effect ones because certain experimental parameters had wide variations. When necessary (i.e., when the

outcome was not continuous, such as functional tests assessed by a dichotomous yes/no answer), odds ratios reported in individual studies were converted to SMDs [26]. The SMD can be seen as an effect size (ES) calculated as the difference between 2 means divided by the standard deviation and was interpreted according to Cohen's recommendations (*Statistical Power Analysis for the Behavioral Sciences*, 2nd ed., New Jersey: Lawrence Erlbaum, 1988), defining ES bounds as small (0.2), medium (0.5) and large (0.8). The type I error was fixed at 5%. Statistical heterogeneity between results was assessed by examining forest plots, confidence intervals and the I^2 statistic. I^2 values range from 0% 100% and are typically considered low at <25%, modest 25–50%, and high >50%. $P<0.05$ was considered statistically significant.

Results

Overview of included studies

The database search resulted in 1581 articles. Ultimately, 11 original articles were eligible for full-text review for the efficiency of non-rigid lumbar support in NSLBP [27–37]. Among these articles, 4 [27,28,33,36] were eventually selected for the meta-analysis (Fig. 1). Trials were excluded because of improper study design (cohort study) [32], inappropriate lumbar support ("spinal underwear") [37], and inappropriate study methodology [30]. For this last study, using a non-randomized clinical trial design, 3 groups were compared (no LBP/no orthoses; no LBP/orthoses; LBP/orthoses), but the only interesting data to extract was for LBP with lumbar orthoses. Some data were missing for 2 articles [33,34]. For the first [33], the authors could not provide the data, but we succeeded in extracting sufficient data to include it in the final analysis. We received no answer from the authors of the second article [34].

Assessment of methodological quality (Fig. 2)

We used the 11 items of the PEDro scale but as stated in the PEDro guide. Quality assessment was homogeneous. The mean score was 6.5 out of 10, including 2 reports with a score of 6 and 2 with a score of 7. Patients, therapists and outcome assessors could not be blinded because the lumbar support was worn. One study did not have similar population characteristics at baseline for the intention-to-treat population [27], and one did not have measurements for at least 85% of the participants [33]. All studies mentioned their randomization method except one, which did not mention whether the allocations were concealed [30].

Characteristics of participants (Table 1)

In the 4 studies, 777 participants were included, 378 in the lumbar support group and 348 in the control group; population sizes ranged from 36 to 433 individuals. The proportion was higher for males (61.5%) than females. The proportion of females was superior in one study [37] and inferior in 3 studies. The mean age was from 38 to 48 years. The mean body mass index, reported in 2 studies, was > 29 kg/m^2 [33,36]. Only one study reported physical activity [27]: 250 (57.7%) participants practiced regular exercise outside of work. Overall, 36 participants had acute LBP, 210 had subacute LBP, 24 had chronic LBP, and 175 had recurrent LBP; 35 had acute or subacute LBP. Two studies detailed professional categories. One study was of manual workers, with 433 participants [33]. Another study enrolled 36 participants: 17 sedentary workers and 19 manual workers [28]. Three studies revealed the use of medication [27,33,36]: 456 of 741 (48%) participants took medication. The medication could be an association of analgesics (paracetamol or aspirin) and a muscle relaxant possibly prescribed to all participants for 8 days. Also, patients could take narcotics, non-steroidal anti-inflammatory drugs, corticosteroids or antidepressants.

Characteristics of the intervention

The 4 studies used serial manufactured lumbar supports. The main characteristics were a soft elastic lumbar belt with back reinforcements. One study [36] used 2 different lumbar supports: one elastic and one inelastic with posterior reinforcements. The length of time the lumbar supports were worn ranged from 2 weeks [36] to 48 weeks [33].

Outcomes (Table 2)

Disability assessment involved different scores, including patient-reported outcome measures (PROMs). Two different scores were used: Oswestry Disability Index [38] for 2 studies [33,36] and Roland Morris Disability Questionnaire [39] for 1 study [27]. One study used functional tests assessed by a yes/no answer [28]. To be compared, PROMs were normalized to a base of hundreds. Pain assessment was assessed with a visual analog scale [27,33,36] or verbal rating scale (VRS) [28]. Pain scores were normalized to a base of hundreds. No adherence assessment was performed in the selected studies.

Study design

Three studies were multicentre [27,28,33]; 2 were conducted in France [27,28] and 2 in the United States [33,36]. All studies were RCTs. Randomization was computer-generated in 2 studies [27,36] and was manually performed with opaque envelopes in the 2 remaining studies [28,33].

Selection of participants in the included articles

Inclusion criteria were male or female adults with acute LBP for a maximum of 10 days [28], with treatment for an initial episode or recurring non-specific LBP, episodes lasting 1 to 3

months [27] or the primary report indicating acute, subacute, or chronic LBP [36] or having a non-traumatic work-related low-back disorder within 8 weeks of the date of diagnosis of an injury/illness [33]. Exclusion criteria included secondary forms of LBP, neurological signs, spinal surgery, current pregnancy (in 2 studies [27,36]), and contraindication to NRLSs.

Evaluation of the therapeutic effect

The systematic review did not find any recommendations for the prescription of NRLS for non-specific LBP. NRLS was effective for disability, pain, and pain-killer consumption for subacute LBP (increases of time intervals for dispensing medication). It was also effective for secondary prevention of LBP recurrence. Benefits of lumbar supports were not highlighted, possibly because of lack of adherence.

No adverse effects were reported for the studies.

For the 4 studies included in the meta-analysis, the pooled standard mean difference showed statistically significant reduced disability with NRLSs compared to standard management: ES -0.54 (95% CI -0.90; -0.17) with substantial heterogeneity (I^2 = 71.7%, p=0.014) (Fig. 3). Results were stratified by duration of LBP and were statistically significant for all studies for acute (-0.97, -1.89; -0.06), subacute (-0.33, -0.61; -0.05) and recurrent LBP (-0.24, -0.45; -0.03). Concerning pain criteria, 3 of the included studies showed reduced pain (ES -0.29, 95% CI -0.46; -0,12), with I^2 = 5.4% (p= 0.348) (Fig. 4).

Discussion

The main findings were that NRLSs demonstrated significant improvements in disability and pain. Insufficient data prevented the comparison of the efficiency among acute, subacute and recurrent LBP, nor did it allow for meta-regression of the sociodemographic and other characteristics of individuals who could benefit the most from NRLSs.

To our knowledge, this is the first systematic review to highlight the effects of NRLSs through meta-analysis. Other systematic reviews, such as the Cochrane Library review, did not conduct a meta-analysis because of the heterogeneity of the study populations and the outcomes [23]. The review drew conclusions concerning NRLSs used for prevention or treatment with no improvement for prevention and limited evidence of alleviation of disability when treating LBP. These results can be explained by the low methodology score, with 9 of the 15 studies included published before 1995 and the outcomes sometimes not accurate enough to show a difference as being an overall improvement. However, a few high-quality RCTs demonstrated the efficacy of NRLSs [27]. Only a few studies were of good methodological quality because of the low number of participants, absence of real blinding, and lack of assessment of co-interventions. Moreover, the heterogeneity in choice of outcome variables and measurement instruments hinder comparisons between studies and systematic reviews [40]. Disability is considered by researchers, clinicians and patients to be the most important outcome domain to be assessed in LBP clinical trials [41]. NSLBP concerns very heterogeneous patient phenotypes that could lead to a major risk of bias, particularly when comparing interventions with limited samples.

To overcome this situation, we focused on only the most pertinent primary outcomes, such as disability and pain, to evaluate the effectiveness of NRLSs. The stratification by duration of LBP can reflect the clinical reality and avoid any bias linked to differences in management. However, this classification has some limitations. Chronic LBP is a particular entity and is part of chronic pain, which has psychosocial consequences and needs a more general management. Some acute LBP, which is not managed as well as possible, can last > 3 months without being considered chronic pain. Moreover, subacute LBP cannot be individualized. It is considered a longer acute LBP or a “pre-chronic” phase for which more intensive care is

needed. So, this classification is insufficient for classifying different pathophysiological mechanisms of different diseases.

Concerning the selection of the articles, 3 different PROMs for disability were used in the selected studies: Oswestry Disability Index [38], Roland Morris Disability Questionnaire [39] and close-ended questions. We had to convert scores to a base of hundreds to compare data. For one study, disability was assessed with clinical functional tests because at the time of publication (1999), the use of questionnaires was not common-place and authors lacked validated questionnaires for LBP. We decided to keep this study in the quantitative analysis because of its good methodological quality and the very limited number of studies of acute LBP. To our knowledge, comparability between disability questionnaires was not represented in the literature, but disability is one of the most important outcomes for LBP rather than pain intensity itself [41].

The benefits of lumbar supports in disability and pain

NRLSs are easily prescribed medical advices with no serious adverse effects. The only side effects could be an increase in localized heat or sweating, which may be uncomfortable, particularly for overweight people.

LBP, mainly chronic LBP, leads to a fear of movement and results in patients reducing their activity to avoid pain. Sedentarism is a worsening factor and leads to chronicization through global deconditioning.

The main purpose of treatment of LBP is to reduce disability and pain. All included studies showed an amelioration of disability except for Oleske et al. [33], whose results were not significant for pain and disability and showed only a decrease over the 12-month follow-up with a significant reduction in LBP recurrence.

Because of their biomechanical properties, NRLSs increase spine stability and are used to relieve the impaired lumbar proprioception in people with LBP [42]. Morisette et al. [36] showed greater improvement in the pain and disability scores (Oswestry Disability Index) with inextensible lumbar support and linked it to the increase in trunk stiffness and motion limitation that it provides. In fact, spinal muscles are over-activated to provide a compensatory stiffness to the spine [43].

Moreover, NRLSs may have a psychological impact that can help restore confidence in the back, reduce the fear of movement and facilitate a gradual return to activities [44].

Increasing abdominal pressure can lead to increased spine stability by increasing the stiffness of trunk muscles and favouring muscle contraction [45]. The local increase in heat could also help reduce pain, even if this effect has not been definitively demonstrated.

As previous reviews have mentioned, the heterogeneity of the NSLBP population and the outcomes were major difficulties in a meta-analysis of this topic. However, we found that some good methodological studies exist and show the efficacy of lumbar supports.

Limitations

The first limitation is the limited number of trials included, 4. Numerous published studies concerned the biomechanical action of lumbar supports, with many studies focusing on muscular effects, posture effects, and proprioception, but only a limited number of randomized clinical studies assessed disability. In addition to the lack of RCTs, published studies did not use the same outcomes or the same orthoses. Moreover, the prescription of orthoses is cultural, with some countries prescribing them more than others. We selected only French and English articles and may have missed studies published in other languages.

Second, most trials were of low methodological quality. Prevalent methodological flaws among the selected RCTs were no concealment of treatment allocation (item 2), no

assessment of co-interventions (item 4) and adherence (item 5), and no blinding of patients (item 6) and outcome assessors (item 7) owing to the impossibility to deliver a placebo.

Assessment of adherence was not mentioned in any report. It is a confounding factor when studying effectiveness and is a potential bias because the length of time the support is worn might be a predictor of efficacy [46]. Assessment of adherence should be part of these studies and measured by the length of time the support is worn. This assessment was lacking in most publications of NRLSs and there is a need for further study of this domain. Some studies have developed methods to quantify adherence, such as temperature recording sensors [47].

Phenotypes of patients who can benefit the most from lumbar supports

The next step is to identify risk factors of non-adherence and individuals with an adherent profile. Roelofs et al. [48] analyzed the determinants of intention to use a lumbar support among home care workers. For these workers, the perceived benefit must be superior to the discomfort, which is why they are unlikely to experience benefits from its use in primary intention. A positive attitude was found the strongest predictor for intention, followed by good self-efficacy. Conversely, obesity or poor self-efficacy was correlated with low intention to use.

Some studies investigated the factors affecting adherence and found that these could be categorized into patient-centred, therapy-related, social and economic, healthcare system, and disease factors [49]. So, the physician has to consider these different factors before prescribing, and the patient must be informed about factors affecting adherence before prescription. Adherence and persistence are related to treatment satisfaction and treatment satisfaction is explained by compliance or persistence [50].

Systematic or collective prescription of lumbar orthoses cannot be recommended. Patients with adherent profiles, with a positive vision of the treatment, recurrent pain or with a positive expectation could be more capable of receiving lumbar support.

We lack studies concerning the cost-effectiveness of lumbar supports. Roelofs et al. [51] showed that wearing an NRLS as a secondary prevention, in addition to usual care, was correlated with reduced sick leave.

Conclusions

Among non-pharmacologic treatments for NSLBP, NRLSs are a non-negligible option. The large population described as having NSLBP is problematic for generating good-quality evidence about the effectiveness of NRLSs. Patient profiles with a potential good response might exist, and further studies should explore the effectiveness of NRLSs regarding patient phenotypes. Further studies should include patients from a homogeneous population, classified by the duration of the pain. Precise and validated patient-reported outcomes, such as disability and pain scores, should be standardized and used in investigations. Adherence should be assessed. Other studies concerning cost-effectiveness in the whole NSLBP population are needed.

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Conflict of interest. EC has regular consulting activities for Thuasne, which was not involved in the study design; collection, management, analysis, and interpretation of data; writing of the report; or decision to publish the results. The other authors declare that they have no competing interests.

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Authors' contribution. Conception and design of the study. PG, CL, FD, LB, BP, EC; Drafting of the original protocol. CL, LB, BP, EC; Acquisition of data. PG, CL, LB, EC; Coordination of the study. BP, EC; Design of the statistical analysis plan. FD, BP, EC; Data analysis and interpretation. PG, FD, BP, EC; Drafting of the present manuscript. PG, FD, BP, EC; Final approval. PG, CL, FD, LB, BP, EC.

Legends

Figure 1. Flow diagram of the articles in the study.

Figure 2. Methodological quality of the studies according to the PEDro scale. Yes = + (1 point), No = - (0 points), Can't say = ? (0 points), Not applicable: NA

Figure 3. Forest plot of effect of lumbar orthoses on function. ES, effect size; 95% CI, 95% confidence interval

Figure 4. Forest plot of effect of lumbar orthoses on pain. SMD, standardized mean difference; 95% CI, 95% confidence interval

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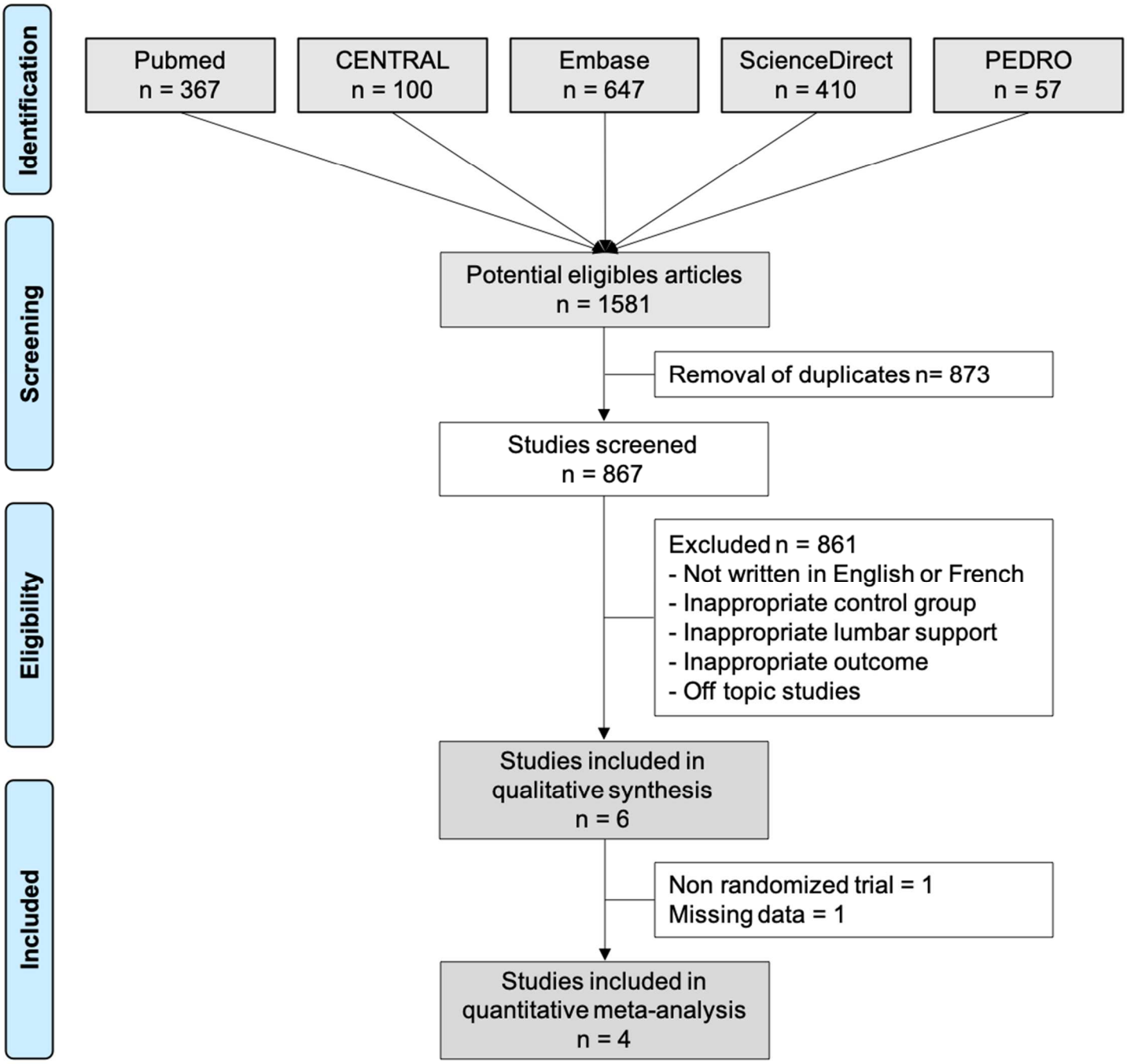
Fig. 1.


Identification
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Embase
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PEDRO
n = 57
Potential eligibles articles
n = 1581
Removal of duplicates n= 873
Studies screened
n = 867
Excluded n = 861
- Not written in English or French
- Inappropriate control group
- Inappropriate lumbar support
- Inappropriate outcome
- Off topic studies
Studies included in
qualitative synthesis
n = 6
Non randomized trial = 1
Missing data = 1
Studies included in
quantitative meta-analysis
n = 4

Figure 2.

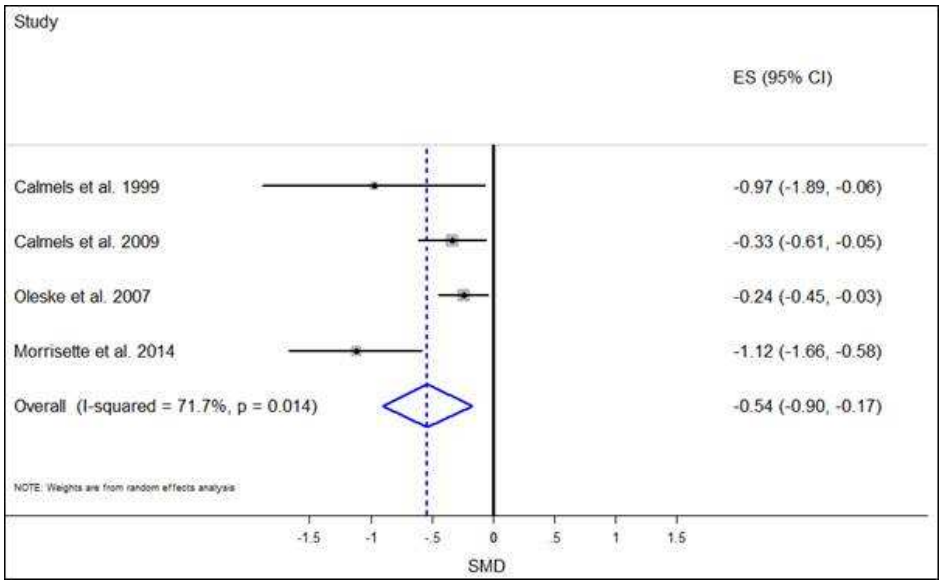
Study
ES (95% CI)
Calmels et al. 1999
-0.97 (-1.89, -0.06)
Calmels et al. 2009
-0.33 (-0.61, -0.05)
Oleske et al. 2007
-0.24 (-0.45, -0.03)
Morrisette et al. 2014
-1.12 (-1.66, -0.58)
Overall (I-squared = 71.7%, p = 0.014)
-0.54 (-0.90, -0.17)
NOTE: Weights are from random effects analysis
-1.5
-1
-.5
0
.5
1
1.5
SMD

Figure 3.

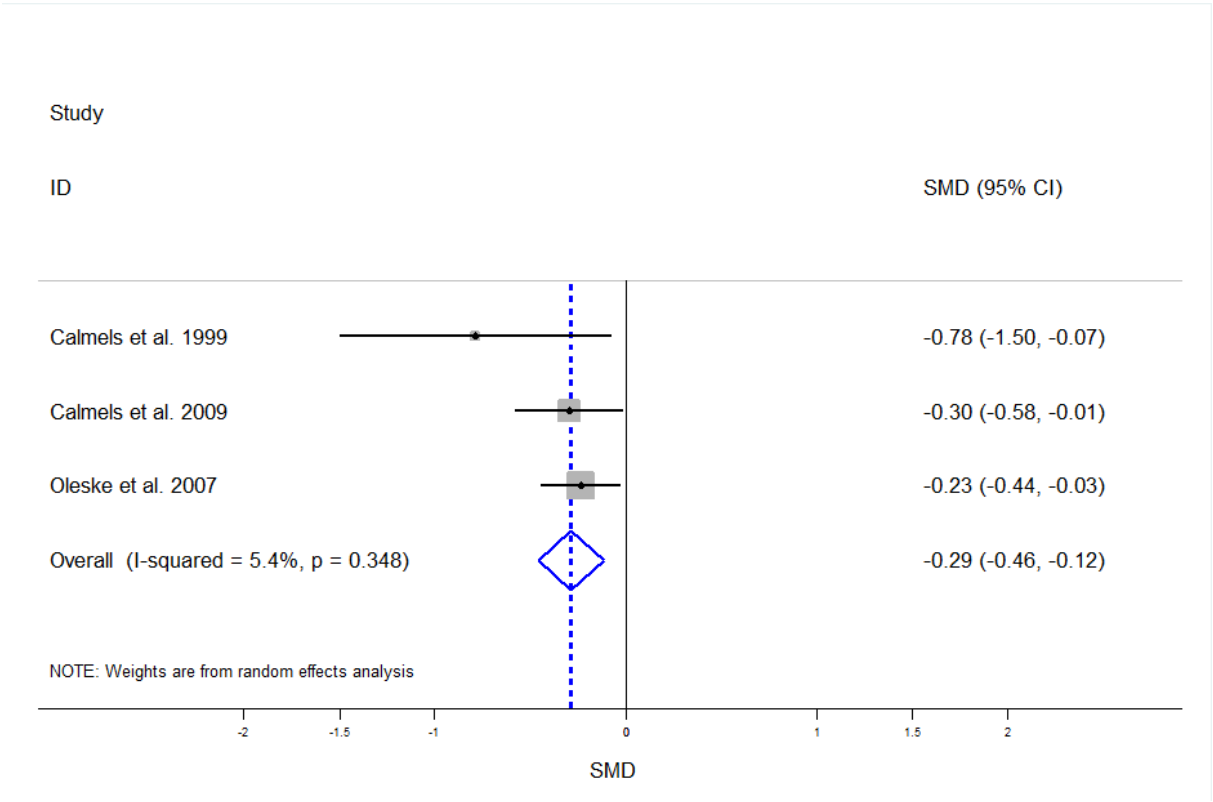
Study
ID
SMD (95% CI)
Calmels et al. 1999
-0.78 (-1.50, -0.07)
Calmels et al. 2009
-0.30 (-0.58, -0.01)
Oleske et al. 2007
-0.23 (-0.44, -0.03)
Overall (I-squared = 5.4%, p = 0.348)
-0.29 (-0.46, -0.12)
NOTE: Weights are from random effects analysis
-2
-1.5
-1
0
1
1.5
2
SMD

Figure 4.

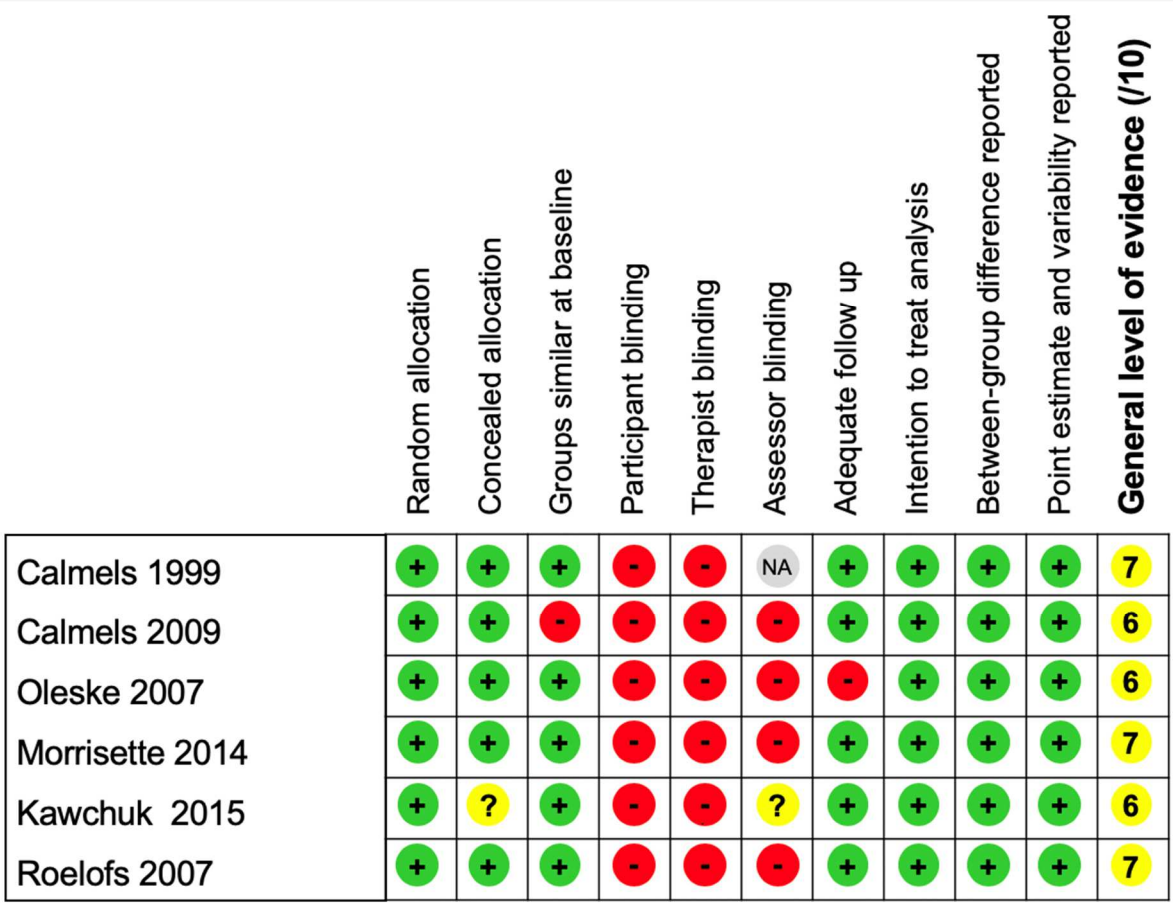
Random allocation
Concealed allocation
Groups similar at baseline
Participant blinding
Therapist blinding
Assessor blinding
Adequate follow up
Intention to treat analysis
Between-group difference reported
Point estimate and variability reported
General level of evidence (/10)
Calmels 1999
Calmels 2009
Oleske 2007
Morrisette 2014
Kawchuk 2015
Roelofs 2007
NA

Table 1. Characteristics of the trials of low back pain (LBP) and non-rigid lumbar supports (LSs) included in the qualitative synthesis: population, intervention, measurements

Study	Population						Intervention		Measurement time (weeks)		
	n	Age mean (SD)	Sex % Male	Mean BMI (kg/m^2) mean (SD)	Professional work (n)	Type of LBP	Type	Duration	T1	T2	T3
Calmels 1999	36	38.3 (10.2)	72.2	Unknown	Sedentary (17) Manual (19)	Acute	Gr 1: LBP + LS Gr 2: LBP + usual care	3 weeks	1	3	-
Kawchuk 2015	54	36.1 (13.5)	51.8	Unknown	Unknown	Acute	Gr 1: LBP + LS Gr 2: healthy controls Gr 3: healthy controls + LS	2 weeks	2	-	-
Calmels 2009	210	43 (10.7)	54.8	Unknown	Unknown	Subacute	Gr 1: LBP + LS Gr 2: LBP + usual care	12 weeks	4	8	12
Oleske 2007	433	46.1 (7.6)	79.8	29.9 (5.4)	Manual (433)	Recurrent	Gr 1: LS + education Gr 2: education	48 weeks	48	-	-
Roelofs 2007	360			Unknown	Manual	Recurrent	Gr 1: LS Gr 2: usual care + education	48 weeks	48	-	-
Morrisette 2014	98	48 (15.3)	39	29.0 (7.2)	Unknown	Mixed	Gr 1: iLS + usual care Gr 2: eLS + usual care Gr 3: usual care	2 weeks	2	-	-

BMI, body mass index

Table 2. Characteristics of the trials included in the qualitative synthesis: outcomes, results

Study	Primary outcome	Secondary outcome	Results		
			T1	T2	T3
Calmels 1999	Pain (VAS, VRS)	-	Gr1> Gr2	NS	-
	Pain attitude	-	NS	NS	-
	Lumbar stiffness	-	Gr1> Gr2	NS	-
	Muscle contraction	-	Gr1> Gr2	NS	-
	Disability (clinical test)	-	NS	Gr1> GR2	-
Kawchuk 2015	Disability (ODI)	-	Decrease	-	-
	-	Spinal stiffness	NS	-	-
	-	Muscle endurance	Increase	-	-
Calmels 2009	Disability (RMDQ)	-	Gr1> Gr2	-	Gr1> Gr2
	Pain (VAS)	-	Gr1> Gr2	-	Gr1> Gr2
	Drug consumption	-	Gr1> Gr2	-	Gr1> Gr2
Oleske 2007	Pain (VAS)	-	NS	-	-
	Disability (ODI)	-	NS	-	-
	Recurrence	-	Gr1> Gr2	-	-
	Physical health	-	NS	-	-
	Mental health	-	NS	-	-
Roelofs 2007	Number of days of LBP	-	Gr1> Gr2	-	-
	Sick leave	-	NS	-	-
	-	Disability (Quebec*)	Gr1> Gr2	-	-
Morrisette 2014	Disability (ODI)	-	Gr1> Gr3	-	-
		Pain (VAS)	NS	-	-
	-	PSAS	Gr1> Gr3	-	-
		FABQ	NS	-	-

FABQ, Fear and Avoidance Beliefs Questionnaire; NS, non-significant; ODI, Oswestry Disability Index; PSAS, Patient Specific Activity Score; RMDQ, Roland Morris Disability Questionnaire; VAS, visual analog scale; VRS, verbal rating scale; *Quebec Disability Scale