

Effects of a Guided Neck-Specific Exercise Therapy on Recovery After a Whiplash

A Systematic Review and Meta-analysis

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Objective: To analyze the effects on pain and disability recovery after a whiplash of a guided neck-specific exercise therapy, compared to a different or an unguided neck-specific exercise therapy.

Design: A literature search was conducted from inception to May 31, 2023, in three electronic databases: PubMed, ScienceDirect, and Web of Science. Eleven randomized controlled trials were included. Meta-analyses were performed with Review Manager software. The standardized mean difference with a 95% confidence interval was used to measure the effect sizes and only short-term time points were considered.

Results: Not all studies reported a significant decrease of pain and disability in the neck-specific exercise group compared to controls. However, meta-analyses demonstrated a significantly greater decrease in neck pain (standardized mean difference: -0.25 ; 95% confidence interval: $[-0.38, -0.12]$; $P=0.0002$) and neck-disability index (standardized mean difference: -0.35 ; 95% confidence interval: $[-0.54, -0.15]$; $P=0.0005$) in the neck-specific exercise group.

Conclusions: In addition to the benefits that a guided neck-specific exercise therapy has on motivation and program adherence, it provides greater benefits in pain and disability than a different or unguided neck-specific exercise therapy. Positive results are observed primarily with intervention periods of more than 6 wks and at least two sessions per week.

Key Words: Rehabilitation, Neck Pain, Neck Disability, Exercise Therapy

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What Is Known

- Whiplash-associated disorders such as pain and disability, are common after whiplash injury, and a high percentage of affected individuals do not fully recover. Among the different options to improve muscle function and alleviate pain, health practitioners frequently suggest a neck-specific exercise therapy, but is not always supervised.

What IS New

- This systematic review and meta-analysis demonstrated that a supervised neck-specific exercise therapy reduces neck pain and neck disability after a whiplash to a greater extent than different or unguided exercise therapy. Greater improvements are observed with more than 6wks and two sessions per week.

The incidence and prevalence of whiplash have increased over the years, making it one of the most common injuries in adults and the most frequent in road traffic accidents.¹ It is considered a major public health problem and is associated with substantial social and economic costs.²

Whiplash-associated disorders (WADs) such as pain, dizziness, and disability, are common after whiplash injury, and

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CME Objectives: Upon completion of this article, the reader should be able to: (1) Determine the impact that whiplash-associated disorders have on a patient's life; (2) Identify and recognize the greater benefits of a supervised exercise therapy on recovery after a whiplash injury; and (3) Differentiate between the different exercise protocols conducted (types of exercises and duration) and incorporate therapy appropriately as part of an effective treatment plan.

Level: Advanced

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up to 60% of affected individuals will not fully recover.³ The persistence of symptoms in individuals with WAD has been attributed to neck-related disability,⁴ including altered neck muscle function,^{5,6} and decreased cervical range of motion (ROM).⁷ Previous reviews have reported high initial pain and disability as indicators of poor prognosis.^{8,9}

Patients may report midline, bilateral or unilateral neck pain, often radiating to the shoulders, trapezius and sometimes to the temporal or frontal region.¹⁰ The cervical rectification and stiffness caused by whiplash greatly affect patients' ROM in all primary neck movements (cervical flexion, lateral flexion, and rotation).¹¹ It is estimated that these movements are reduced by 25%, both passive and active, compared to subjects without whiplash or WAD.¹² Other symptoms such as sleep disturbances are also common in individuals with WAD and are associated with the intensity of ongoing pain.¹³

Treatment for whiplash varies by symptom severity. Treatment options include physiotherapy, cervical orthoses, nonsteroidal anti-inflammatory drugs, muscle relaxants, thermotherapy, corticosteroid injections, and radiofrequency therapy. Surgery is sometimes performed in severe cases.^{10,13,14}

One intervention commonly suggested by clinical practice guidelines is exercise therapy, which health practitioners frequently use to improve muscle function and alleviate pain.¹⁵ Basic body awareness, consisting of exercises based on activities of daily living and becoming aware of body posture, has also shown promising results.¹⁵ While general exercise delivered alone or in combination with advice did not achieve better outcomes than advice alone,¹⁶ a neck-specific exercise (NSE) therapy focusing on motor relearning, neck stabilization, and endurance, with or without a cognitive behavioral approach, produced better improvements in variables such as neck pain or neck disability than general physical activity.^{17,18}

Supervising exercise is a strategy that may improve the impact of workplace exercise programs.¹⁹ Studies involving different injured patients have reported greater improvements to health, fitness, and quality of life outcomes, such as aerobic capacity,²⁰ fatigue,²¹ and musculoskeletal pain,^{22,23} for patients given supervised compared to unsupervised or home-based exercise over periods of 6 wks to 12 mos. These findings are potentially mediated through increased motivation²⁰ and program adherence.²⁴ Supervised exercise therapy for chronic WAD can improve self-efficacy beliefs and reduce disability and fear of movement/reinjury compared to home training or advice,^{25,26} but there is no agreement regarding the number of sessions per week or the duration of the sessions.

To our knowledge, no systematic review or meta-analysis examined the effectiveness of supervised NSE therapy on pain and disability in patients with WAD. Other systematic reviews have compared the effects of an exercise therapy compared with other interventions, placebo interventions or no treatment²⁷; the effectiveness of physiotherapy management compared to placebo interventions, no management, or standard care²⁸; or the effectiveness of cognitive behavioral therapy, alone or in combination with physical interventions, compared to other therapies, advice, or no therapy.²⁹ However, none have investigated the efficacy of a supervised NSE therapy compared to any other therapy type. Therefore, given the importance of a supervised therapy in terms of motivation and adherence, this systematic review and meta-analysis aimed to assess

the effects of a guided NSE therapy on pain and disability recovery after a whiplash injury compared to a different or unguided NSE therapy.

METHODS

Search Strategy

This systematic review and meta-analysis was designed according to the guidelines of the Preferred Reporting of Systematic Reviews and Meta-Analyses statement (see Supplementary Checklist, Supplemental Digital Content 1, <http://links.lww.com/PHM/C327>).³⁰ The protocol was registered at PROSPERO, an international database of prospectively registered reviews in health and social care (CRD42022315373). Two of the authors performed the literature search, study selection, and data extraction. Any disagreement was resolved by consensus.

The literature search was conducted in three electronic databases from inception to May 31, 2023: PubMed, ScienceDirect, and Web of Science. The following search was performed: whiplash (Title) AND (exercise OR exercises OR therapy OR physiotherapy OR rehabilitation OR training OR mobilization (Title)). The search was limited to English language and journal articles. The "randomized control trial" filter was unavailable in the ScienceDirect and Web of Science databases; therefore, it was applied only in the Pubmed database. The reference sections of selected articles were also manually searched to identify additional relevant studies.

Inclusion and Exclusion Criteria

The studies included in this systematic review and meta-analysis met the following inclusion criteria: (i) research conducted with human participants, (ii) original articles in peer-reviewed publications, (iii) original studies that investigated the effects of a guided neck-specific exercise therapy on neck pain (measured with a 0–100mm visual analog scale (VAS), or other 0–10 rating scale), and/or neck disability index (NDI) after a whiplash, (iv) research conducted with one control/placebo group that received a different therapy, and (v) articles published from inception through May 31, 2023. Exclusion criteria were: (i) non-English articles, (ii) studies that underwent surgery, (iii) systematic reviews or meta-analyses, (iv) studies with a guided NSE therapy of less than a session per week, and (v) studies that reported only qualitative results.

Data Extraction

The following data were extracted from each study: first author name, publication year, clinical condition, guided NSE group (NSEG) and control group (CG) characteristics, exercise period, intervention type, and the effects of the intervention on functional measures.

Methodological Quality Assessment

The methodological quality of the selected articles was assessed by two of the authors using the PEDro scale, which is based on the Delphi list developed by Verhagen et al.³¹ It is a reliable and objective tool that helps identify which studies are likely to be externally valid (criterion 1), internally valid (criteria 2–9), and could have sufficient statistical information to make their results interpretable (criteria 10 and 11).³² Points

are only awarded when a criterion is clearly satisfied, and criterion one, which relates to external validity, is not used to calculate the PEDro score. A score of 9–10 on the PEDro scale was considered to be “high quality,” scores of 5–8 were deemed to be “moderate quality,” and studies that scored below 5 were considered to be “low quality.”³³ Discrepant results were resolved through discussion.

Statistical Analysis

Review Manager software (version 5.4.1; Cochrane Collaboration, Oxford, UK) was used to create the forest plots and conduct the statistical analysis. The standardized mean difference (SMD) with a 95% confidence interval (CI) was used to measure the effect sizes (ESs) for neck pain and NDI. In cases that reported the median, the minimum, the maximum values and the sample size, or the median, the first quartile, the third quartile and the sample size, the mean and the standard deviation were calculated according to the formulas proposed by Wang et al.³⁴ When necessary, the data were calculated from figures via WebPlotDigitizer. It is a program that converts graphical data to numerical data through manual plotting with high reliability³⁵ and has been used in other meta-analysis.^{36,37}

Most studies had multiple follow-up points but only the short-term points were considered (≤ 3 mos) to include sufficient studies in the meta-analyses. Statistical heterogeneity of the treatment effects among studies were assessed using Cochran's Q test and the inconsistency I^2 test, and fixed-effect models were used ($I^2 < 50\%$, $P > 0.1$). A sensitivity analysis using the one-study removed method was also conducted to determine the influence of each study on the overall results. The calculated ESs were interpreted using the conventions outlined for SMD: < 0.2 , trivial; 0.2 – 0.6 , small; > 0.6 – 1.2 , moderate; > 1.2 – 2.0 , large; > 2.0 – 4.0 , very large; > 4.0 , extremely large.³⁸

Publication Bias

Potential publication bias was not evaluated because there were fewer than 10 studies included in each meta-analysis, and this is the minimum eligible to test publication bias.^{27,39}

RESULTS

Search Results

The initial literature search identified 198 articles. After examination of the titles, 61 articles were excluded. After removal of duplicates, 80 articles were selected for abstract screening, of which 24 were selected for full-text reading. After exclusion of another 13 articles that did not fulfill the eligibility criteria, 11 studies were finally included in this systematic review and meta-analysis.^{15,17,25,40–47} A summary of the search process is depicted in Figure 1.

Study Characteristics

The characteristics of the included studies are summarized in Table 1. All selected studies were randomized placebo-controlled trials that used a parallel-group design. The total number of participants was 1276 with sample sizes ranging from 13 to 153 participants in each group. Because three studies^{25,43,47} did not perform an a priori statistical power analysis, they may not have used adequate sample sizes. The remaining studies

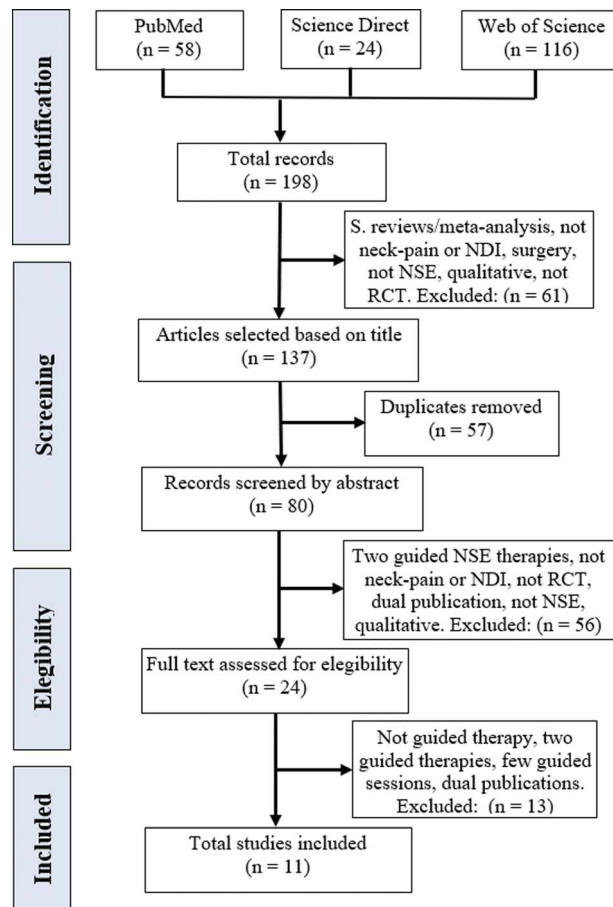


FIGURE 1. Flowchart of the literature selection process for the systematic review and meta-analysis.

did perform an a priori or post hoc statistical power analysis for the primary outcomes. However, due to technical reasons, Hansson et al.⁴⁴ used a smaller sample size than necessary. Three studies used three different groups but only two of them were included in our analyses.

All selected studies were conducted with both women and men, except for Bunketorp et al.,²⁵ who did not report the sex of the participants. The mean age of the groups ranged from 28.0 to 48.7 yrs. The exercise period differed greatly across the included studies, ranging from 2 wks to 3 mos, except for Sholten et al.,⁴⁰ whose participants ended the treatment when the health problem was resolved, and the maximum duration of the intervention was 9 mos. Most of the studies had two or three sessions per week, except for Sholten et al.,⁴⁰ who did not report it, Vassiliou et al.,⁴¹ who performed 10 sessions within 14 days, and Michaleff et al.⁴⁵ with 20 sessions in a 12-wk period. The intervention protocol was also different across the included studies and is detailed in Table 2.

Methodological Quality

All studies were considered to be of moderate quality with quality scores ranging from five to eight (of a maximum of 10) and had a mean PEDro score of 7.09 ± 1.00 . No study was excluded due to its low quality. Supplemental Table 1 (see Supplemental Digital Content 2, <http://links.lww.com/PHM/C328>)

TABLE 1. Characteristics of the included studies

Study	Sample Size	Sex (M/W)	Mean Age (Years)	NSE Therapy
Bunketorp et al. ²⁵	22 (NSEG) 25 (CG)	NR	38 ± 11 35 ± 12	Duration of sessions: 1–1 1/2 hrs Twice a week 3-mo period
Sholten et al. ⁴⁰	38 (NSEG) 42 (CG)	11/27 16/26	31.9 ± 9.0 33.8 ± 10.3	Duration of sessions: 30 mins until the problem was solved (9 mos maximum)
Vassiliou et al. ⁴¹	103 (NSEG) 97 (CG)	39/64 38/59	30.1 ± 10.3 28.3 ± 8.9	Duration of sessions: 35 mins Total number of sessions: 10 14-d period
Kongsted et al. ⁴²	149 (NSEG) 153 (CG)	43/106 41/112	33 ± 20 34 ± 15	Median duration of sessions: 38 mins Twice a week (maximum) with therapist 6-wk period
Stewart et al. ⁴⁷	66 (NSEG) 68 (CG)	18/48 27/41	43.9 ± 15.1 42.7 ± 14.4	Duration of sessions: 30 mins Total number of sessions: 12 6-wk period
Dehner et al. ⁴³	32 (NSEG) 20 (CG)	10/22 12/20	28 29	Duration of sessions: — 3 times per week 7-wk period
Hansson et al. ⁴⁴	16 (NSEG) 13 (CG)	6/10 3/10	40 43	Duration of sessions: 50 mins Twice a week 6-wk period
Michaleff et al. ⁴⁵	85 (NSEG) 85 (CG)	37/38 25/60	42.6 ± 12.3 43.1 ± 12.7	Duration of sessions: 1 hr 20 sessions 12-wk period
Peolsson et al. ⁴⁶	23 (NSEG) 18 (CG)	6/17 4/14	39 ± 11.2 38 ± 11.0	Duration of sessions: — 2 sessions per week 3-mo period
Seferiadis et al. ¹⁵	57 (NSEG) 56 (CG)	44/13 37/19	48.7 ± 11.3 47.3 ± 13.3	Duration of sessions: 90 mins Twice a week 10-wk period
Treleaven et al. ¹⁷	41 (NSEG) 55 (CG)	6/35 23/32	37.6 ± 12.4 43.3 ± 10.9	Duration of sessions: — Twice a week 12-wk period

NR, not reported; M, men; W, women.

details the results of the criteria evaluated. All studies failed to blind participants and therapists (items 5 and 6).

The Effects of the Guided NSE Therapy on Neck Pain

Ten studies measured neck pain. Four found a significant improvement in pain levels in the guided NSEG compared to the CG.^{17,41,43,47} Bunketorp et al.²⁵ observed that the reduction in pain intensity tended to be higher in the guided NSEG, but the difference was not significant. Peolsson et al.⁴⁶ found that neck pain decreased in the guided NSEG and increased in the CG, but these differences were not significant. However, four studies showed no differences among the compared interventions.^{40,42,44,45}

A meta-analysis of the eight studies that provided necessary data on neck pain^{17,41–47} demonstrated a significantly greater decrease in neck pain from 6 wks to 3 mos after starting the guided NSE therapy (SMD: -0.25 ; 95% CI: $[-0.38, -0.12]$; $P=0.0002$; $I^2=0\%$; Fig. 2A). The relative weight of each study in the analysis varied between 3.2% and 23.7%, demonstrating a nonequibrated weight distribution. Sensitivity analysis also showed a greater decrease in neck pain in the guided NSEG.

The Effects of the Guided NSE Therapy on NDI

Six studies analyzed the effects of exercise on neck disability.^{15,17,40,45–47} Three of them^{17,46,47} found significant improvements in NDI in the guided NSEG compared to the CG. However, the other three^{15,40,45} found no significant differences between groups.

The pooled ES of the four studies that provided sufficient data^{17,45–47} demonstrated a significantly greater decrease in NDI from 6 wks to 3 mos after starting the guided NSE therapy (SMD: -0.35 ; 95% CI: $[-0.54, -0.15]$; $P=0.0005$; $I^2=37\%$; Fig. 2B). The relative weight of each study ranged from was 9.1% to 38.7%, showing again a nonequibrated weight distribution. In the sensitivity analysis, the results remained consistent across all deletions.

The Effects of the Guided NSE Therapy on Cervical ROM and Headache

Besides neck pain and NDI, only two other variables were measured in more than one study: cervical ROM (CROM) and headache. Four studies^{25,40,43,44} measured CROM at the end of the intervention with a goniometer. However, only one of

TABLE 2. Summary of findings of the included studies

Study	Main Functional Measures	Intervention (NSEG)	Intervention (CG)	Significant Differences in NSEG (vs. CG)
Bunketorp et al. ²⁵	Self-efficacy; neck pain; CROM Measurements: Baseline, 3, 9 mos post	Strength, resistance, and coordination exercises.	Home exercise program twice a day	Greater improvement in self-efficacy and in neck pain (but not significant)
Sholten et al. ⁴⁰	Neck pain; headache; work activities daily life; neck disability; CROM Measurements: 4, 8, 12, 26, 5 wks post	Education, advice, and exercise therapy (strength, coordination, stabilization)	Education and advice	Significant improvement in CROM
Vassiliou et al. ⁴¹	Neck pain; neck disability Measurements: Baseline, 1, 6 wks, 6 mos post	Heat and manual therapy + active exercise (strength and resistance)	Soft collar first 7 d + oral medication	Significant improvement in neck pain and disability
Kongsted et al. ⁴²	Neck pain; headache; neck disability Measurements: Baseline, 3, 6, 12 mos post	Light repetitive movements (series of 10/hr) + end of motion neck movement once a day + guidance	Education and advice	No significant differences between groups
Stewart et al. ⁴⁷	Neck pain; pain bothersomeness; functional ability; neck disability Measurements: Baseline, 6 wks, 12 mos post	Strength, coordination, endurance, and aerobic exercises	Education, advice, and reassurance	Significant improvements in all measured variables in the short term
Dehner et al. ⁴³	Neck pain; CROM Measurements: 24 hrs, 2 mos post	Joint mobilization, coordination, stabilization, and strength exercises	Heat, massage, and electrotherapy	Significant improvement in neck pain
Hansson et al. ⁴⁴	Neck pain; CROM Measurements: Baseline, 6 wks, 3 mos post	Vestibular rehabilitation program (coordination, stabilization, and balance)	No intervention	No significant differences between groups
Michaleff et al. ⁴⁵	Neck pain; neck disability Measurements: Baseline, 14 wks, 6, 12 mos post	Strength, coordination, balance, motor control and aerobic exercises	Education and advice + home exercise	No significant differences between groups
Peolsson et al. ⁴⁶	Neck pain; neck disability Measurements: Baseline, 3 mos post	Neck-specific exercises (motor control, strength, resistance, and isometric)	No intervention	Significant improvement in neck disability
Seferiadis et al. ¹⁵	Neck disability; CROM Measurements: Baseline, 10 wks, 3 mos post	Strength, aerobic and coordination exercises, and muscle relaxation	BAT exercises, meditation and Tai Chi	CG group showed greater reduction in pain.
Treleaven et al. ¹⁷	Neck pain; self-rated dizziness; neck disability Measurements: Baseline, 3, 6, 12 mos post	Strength-resistance exercises	Aerobic exercise at home (walking, cycling)	Significant improvement in all measures

BAT, basic body awareness therapy.

them⁴⁰ found a significant improvement in the guided NSEG compared to the CG. The remaining studies^{25,43,44} observed no significant differences between groups. Two studies^{40,42} measured headache intensity with a VAS or a Box scale. However, neither observed significant differences between groups.

DISCUSSION

As mentioned above, the incidence of whiplash has increased over the years, and symptoms commonly persist in individuals with WAD long after suffering the whiplash. This systematic review and meta-analysis aimed to compare the effectiveness of a supervised NSE therapy on recovery after a whiplash to a different or unguided exercise therapy. Eleven studies met our inclusion criteria, involving a total of 1276 participants. Our findings suggest that a supervised NSE therapy produces greater reductions in neck pain and NDI than other

therapies, making it a better therapy to accelerate recovery after a whiplash.

The Effects of the Guided NSE Therapy on Neck Pain

Only four of the ten studies that measured neck pain found that the reduction in neck pain was greater in the guided NSEG than in the CG.^{17,41,43,47} The remaining studies observed no differences between groups^{40,42,44,45} or differences that did not reach significance.^{25,46} These contradictory results may be affected by the duration of the intervention period, the number of sessions per week, and the duration of the sessions. The studies that conducted interventions longer than 6 wks with at least two sessions per week,^{17,25,43,46,47} tended to show more benefits in the guided NSEG. Vassiliou et al.⁴¹ also observed those benefits after a 2-wk intervention, but the total number

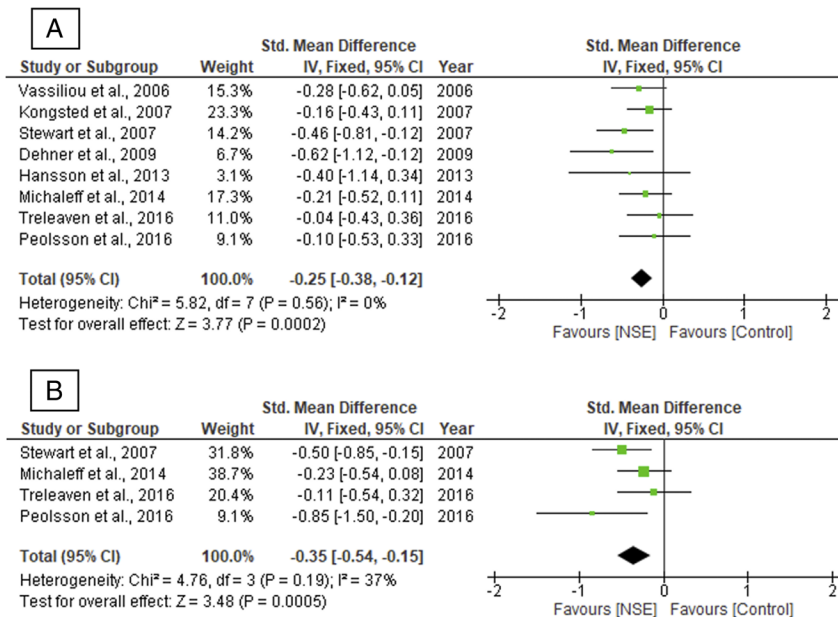


FIGURE 2. Forest plot showing the standardized mean differences and 95% confidence intervals for the effects of neck-specific exercise therapy on neck pain (A) and neck disability index (B).

of sessions in that period was 10, making their number of sessions per week higher than in the other the studies. In contrast, studies that performed interventions with a shorter session duration^{40,44} or fewer sessions per week⁴⁵ showed no benefits.

In addition, most studies achieving a greater (significant or nonsignificant) reduction in neck pain in the NSEG included strength and resistance exercises in their interventions,^{17,25,41,46,47} which may also explain the positive results. However, Kongsted et al.⁴² and Hansson et al.⁴⁴ did not include strength and resistance exercises in their interventions, which instead comprised lower intensity exercises, such as light repetitive movements,⁴² or focused on a vestibular program of coordination and stabilization.⁴⁴ The two remaining studies with no differences between groups did include strength exercises but only for a few minutes per session.^{40,45} Therefore, a guided NSE intervention should incorporate strength and resistance exercises in the program to reduce neck pain intensity in patients with WAD. However, further studies are needed to elucidate the necessary intensity to positively affect neck pain.

The 8 studies included in the meta-analysis, demonstrated a significantly greater neck-pain decrease from 6 wks to 3 mos following the NSE therapy (ES: -0.25 ; $P=0.0002$). While our ES favoring the guided NSEG is small, likely because two of the studies that observed significantly greater improvements in the NSEG did not report sufficient data to be included in the meta-analysis, it suggests that a guided NSE therapy might be more effective in accelerating recovery from neck pain after a whiplash. Nonetheless, new studies with longer therapy periods, more sessions per week, and longer sessions are warranted.

The Effects of the Guided NSE Therapy on Neck Disability Index

Only three of the six studies that examined the effects of a guided NSE therapy on NDI observed greater improvements in

the NSEG than in the CG.^{17,46,47} Again, these contradictory results may be affected by the length of the intervention period, the number of sessions per week and the length of the sessions. The studies that conducted interventions longer than 6 wks with at least two sessions per week^{17,46,47} found more benefits in the guided NSEG. The short duration of the sessions and the low number of sessions per week may be the cause of not finding greater improvements in the NSEG.^{40,45} Seferiadis et al.¹⁵ did not observe significant differences in NDI between the NSEG and the basic body awareness therapy group. However, they observed some trends suggesting better improvement in the latter, and more trials comparing those therapies are required.

The pooled ES of the four studies that provided sufficient data on NDI demonstrated a significantly greater decrease in NDI from 6 wks to 3 mos following the NSE therapy (ES: -0.35 ; $P=0.0005$). Again, our ES favoring the guided NSEG is small, likely due to the few studies included and because one other study that observed significant greater improvements in the NSEG did not report sufficient data to be included in the meta-analysis. However, our results reveal that a guided NSE therapy might be more effective in reducing disability after a whiplash. Nonetheless, new studies with longer therapy periods, more sessions per week, and longer sessions are warranted.

The Effects of the Guided NSE Therapy on CROM and Headache

Only one of the five studies that measured CROM found a significant improvement in the guided NSEG compared to the CG,⁴⁰ which was unexpected because they did not observe significant differences in neck pain or NDI between groups, and the duration of their sessions was the shorter than all the other studies included studies (30mins). Therefore, it can be

concluded that a guided NSE therapy appears not to affect CROM more than other therapies.

Two studies^{40,42} measured headache intensity with a VAS or a Box scale. However, neither observed significant differences between groups. These results are likely due to the short duration of the sessions, and further trials with more intensive programs are required.

Our results highlight the effects of a supervised NSE therapy on reducing WAD, mainly through strength and resistance training, which should be incorporated into the management of these patients. While guided NSE therapy may have some costs associated with its supervision by a professional therapist, it may reduce the adverse effects and elevated costs associated with other medical treatments such as corticosteroid injections, nonsteroidal anti-inflammatory drugs, or surgery. However, this study has several limitations. First, many studies did not report the necessary data for the meta-analysis. Second, the exercise protocol varied substantially between studies. Third, the different grades of WAD in the included participants affected the outcomes of the studies. Fourth, most studies mainly included middle-aged women; hence, these findings are unlikely to generalize to males or older adults. Finally, it was not possible to statistically synthesize the effects of a guided NSE therapy in the long-term after the whiplash, because of the small number of articles that reported it.

CONCLUSIONS

The results of this systematic review and meta-analysis indicated that, in addition to the benefits that a guided therapy has on motivation and program adherence, a guided NSE strategy provides greater benefits in pain and disability than a different or unguided NSE therapy. However, it does not appear to provide greater benefits for CROM. Positive results are mainly observed with interventions that include strength and resistance exercises and intervention periods of more than 6 wks, with at least two sessions per week. Nonetheless, further studies with longer therapy periods, more sessions per week, and longer sessions are warranted.

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