Journal of Bodywork & Movement Therapies 45 (2025) 724–731

Contents lists available at ScienceDirect

Journal of Bodywork & Movement Therapies

journal homepage: www.elsevier.com/jbmt

Visceral manual therapy as an intervention for musculoskeletal disorders: A scoping review

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ARTICLE INFO

Keywords:
Visceral manual therapy
Musculoskeletal pain
Low back pain
Shoulder pain
Cervical pain
Physical therapy

ABSTRACT

Background: Chronic musculoskeletal pain, affecting ~35 % of adults in industrialized countries, impairs physical function, mental health, and quality of life. Visceral manual therapy (VMT), targeting visceral dysfunction to alleviate musculoskeletal pain, is underutilized in clinical practice.
Aims: To evaluate VMT's effectiveness for chronic low back, shoulder, and cervical pain.
Methods: A scoping review, following PRISMA guidelines, searched PubMed, PEDro, and Google Scholar for English-language randomized controlled trials (RCTs), quasi-controlled trials, or pilot studies (2015–2025) involving adults with chronic musculoskeletal pain treated with VMT. Study quality was assessed using the PEDro scale by two independent reviewers.
Results: Nine studies (326 participants, PEDro scores 4–9, mean 6.1) demonstrated that VMT, alone or in combination with conventional physical therapy (e.g., exercises, manual therapy), significantly reduced pain in eight studies, often exceeding the minimal clinically important difference. Improvements in function, lumbar mobility, depression relief, and visceral mobility were noted in some studies; however, the outcomes for range of motion and muscle activation remained inconsistent due to the use of heterogeneous measures. No serious adverse events were reported, though safety data were inconsistently reported, and small sample sizes limit generalizability.
Conclusion: VMT is a promising adjunctive therapy for chronic musculoskeletal pain, particularly when combined with conventional treatments. Clinicians should screen for visceral dysfunction, while future high-quality RCTs with standardized protocols and validated outcomes are needed to strengthen evidence.

1. Introduction

Chronic musculoskeletal pain, affecting muscles, bones, and joints, is widespread, impacting approximately 35 % of adults in industrialized countries (Bergman et al., 2001). Low back pain (LBP) has a prevalence of 19.6 % in adults aged 20–59 years (Meucci et al., 2015) and ranges from 21 % to 75 % in those over 60 (de Souza et al., 2019). Shoulder pain affects 17.3 per 1000 adults aged 45–64 years (Djade et al., 2020), while cervical pain has a one-year prevalence of 4.8–79.5 % (mean: 25.8 %) (Hoy et al., 2010). This pain reduces quality of life (QoL), increases disability, and is linked to depression and strained relationships (Andersen et al., 2014).

About one-third of individuals with chronic pain conditions, such as fibromyalgia or chronic LBP, experience co-occurring abdominal, pelvic, or chest pain, suggesting a connection between visceral (internal organ) and somatic (musculoskeletal) pain (Affaitati et al., 2020; Chang, 1998). Visceral dysfunction, such as gastrointestinal conditions or surgical adhesions, may contribute to musculoskeletal pain through restricted organ movement or pain referral (Switters et al., 2019; Horton, 2015). For example, tight fascial tissues connecting organs to the spine can limit mobility, while prolonged organ-related pain may heighten pain sensitivity in the nervous system, a process known as central sensitization (Cervero, 2009; Pacheco-Carroza, 2021).

Visceral manual therapy (VMT) has roots in early osteopathic principles, pioneered by Andrew Taylor Still in the late 19th century, who emphasized the interconnectedness of the body's systems, including visceral structures. It evolved in the 20th century through therapists like Jean-Pierre Barral, who developed specific visceral manipulation (SVM) techniques in the 1980s, focusing on organ mobility and fascial release (Barral and Mercier, 2005). Over time, VMT has integrated into

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https://doi.org/10.1016/j.jbmt.2025.10.009
Received 20 June 2025; Received in revised form 1 October 2025; Accepted 6 October 2025
Available online 8 October 2025

interdisciplinary fields, such as physical therapy (PT) and manual medicine, expanding from osteopathic-specific approaches to broader applications in rehabilitation, including abdominal massage in PT protocols. This evolution reflects a shift from anecdotal osteopathic practices to evidence-based integration with conventional therapies, driven by growing recognition of visceral-somatic interactions (McSweeney et al., 2012).

VMT employs hands-on techniques to address visceral dysfunction contributing to chronic musculoskeletal pain. This review defines VMT as a broad term encompassing SVM, which targets specific internal organs to enhance mobility and reduce fascial tension, as in Barral's osteopathic method (McSweeney et al., 2012a), and broader, less specific techniques, such as abdominal massage (Santos et al., 2019; Panagopoulos et al., 2015). SVM emphasizes precise organ mobilization, whereas VMT includes techniques to modulate pain signaling, often integrated with conventional PT, such as exercises or manual therapy (Santos et al., 2019). Despite its potential, VMT remains underutilized in clinical practice due to the limited availability of high-quality evidence and standardized protocols.

This scoping review evaluates the effectiveness of VMT, including SVM, for chronic low back, shoulder, and cervical pain. It aims to inform clinical practice by synthesizing current evidence and to guide future research in establishing the role of VMT in musculoskeletal pain management.

2. Methods

2.1. Eligibility criteria

Studies were included if they were:

- Randomized controlled trials (RCTs), quasi-controlled trials, or pilot studies.
- Conducted in adults (≥18 years) with chronic musculoskeletal pain (low back, shoulder, or cervical).
- Published in English within the last 10 years (2015–2025).
- Evaluated VMT as a primary or adjunctive intervention.

Studies were excluded if they focused on non-musculoskeletal conditions (e.g., irritable bowel syndrome, pelvic floor dysfunction), involved pediatric participants, or used animal or laboratory models.

2.2. Search protocol

The review followed PRISMA-ScR guidelines, searching PubMed, PEDro, and Google Scholar. Search terms included: "visceral mobilization," "visceral manipulation," "abdominal massage," "low back pain," "shoulder pain," "cervical pain," and "musculoskeletal pain." The search was limited to studies published from January 2015 to May 2025.

2.3. Data extraction

The authors (M.G. and R.D.C.) extracted data using a standardized form, capturing study design, sample size, intervention details, outcome measures, and results. The supervising reviewer (L.K.) independently verified the extracted data to resolve discrepancies.

2.4. Quality assessment

Methodological quality was assessed using the PEDro scale, which evaluates internal validity and statistical reporting across 10 criteria (e.g., randomization, blinding, and intention-to-treat analysis). Two assessors (R.D.C. and M.G.) independently scored each study, resolving disagreements through consensus.

3. Results

3.1. Study selection

A total of 1791 articles were identified through database searches (PubMed, PEDro, Google Scholar), with 523 duplicates removed. After screening 1268 titles and abstracts, 1199 records were excluded as irrelevant (e.g., non-musculoskeletal focus, non-RCT). Sixty-nine full-text articles were assessed for eligibility, with 60 excluded due to non-RCT/quasi-RCT designs (n = 24), non-English language (n = 12), pediatric or non-musculoskeletal focus (n = 14), or interventions not isolating VMT or SVM (n = 10). Nine studies (326 participants) met the inclusion criteria. The PRISMA flow diagram (Fig. 1) details the selection process.

3.2. Study characteristics

Study characteristics, including design, sample size, participant demographics, and focus on musculoskeletal pain, are summarized in Table 1. The studies included RCTs (n = 7) and quasi-experimental pilots (n = 2), with a total of six being pilots. The mean PEDro score was 6.1 (range: 4–9), indicating moderate to good methodological quality. Five studies addressed low back pain (LBP), two focused on shoulder pain (rotator cuff injuries and adhesive capsulitis), and two targeted cervical

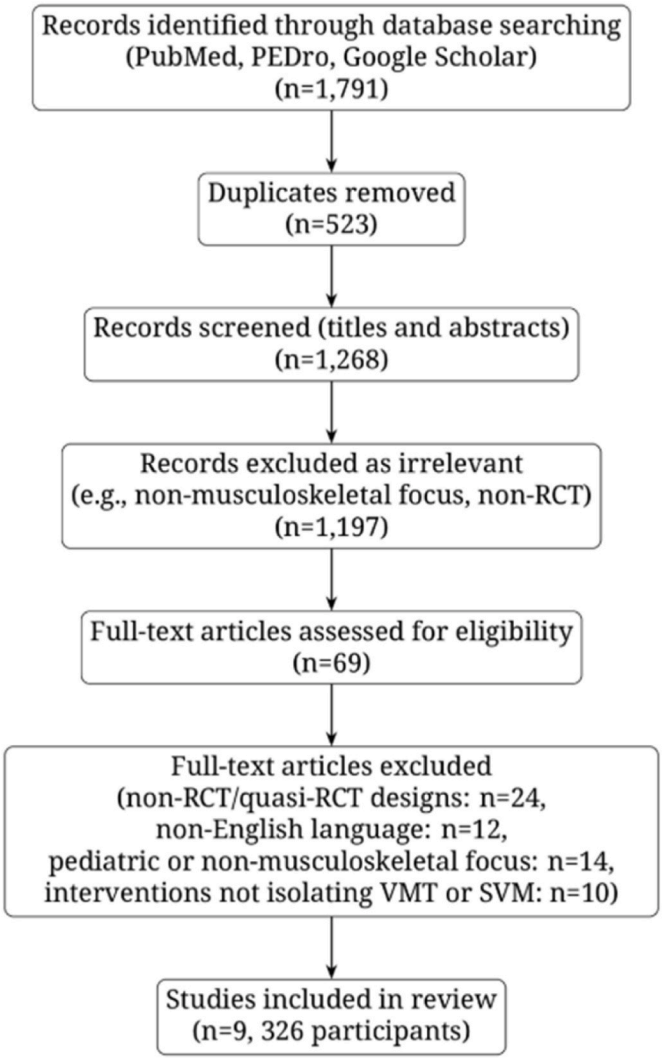

Fig. 1. PRISMA Flow Diagram illustrating the study selection process for the scoping review.

Table 1
Characteristics of included studies.

Study	Design	Age Range	Musculoskeletal Pain	Sex (Female, N)	Treatments and Patients (N)	Outcome Measures	Follow-Up	Key Results
Mughal et al. (2019)	Single-blinded RCT	25–50	Nonspecific LBP	30	Total: 30 EG (15): VM CG (15): Standard PT	NPRS (pain), Sitting-Rising Test (mobility)	Pre/post-treatment, 1 day post	VM reduced pain and improved mobility compared to CG (within-group $p < 0.0001$; no between-group p value reported, but EG showed larger improvements).
Santos et al. (2019)	Double-blinded RCT	18–65	Chronic LBP with visceral dysfunction	19	Total: 20 EG (10): VM + PT CG (10): Placebo VM + PT	VAS (pain), Schober Test (lumbar mobility), Roland-Morris (function), Patient-Specific Functional Scale	Pre/post-treatment, 1 week post	VM + PT improved lumbar mobility and specific function ($p < 0.001$) but not pain or general function vs. CG.
Panagopoulos et al. (2015)	RCT with blinded follow-up	18–80	LBP with gastrointestinal symptoms	39	Total: 64 EG (32): VM + PT CG (32): Placebo VM + PT	NPRS (pain), Roland-Morris (function), Patient-Specific Functional Scale	2, 6, 52 weeks	No short-term differences. At 52 weeks, EG had a 1.69-point lower NPRS ($p = 0.015$).
Tamer et al. (2017)	RCT pilot	36–42	Chronic nonspecific LBP	20	Total: 39 EG (20): VM + osteopathic PT + exercises CG (19): Osteopathic PT + exercises	VAS (pain), SF-36 (QoL), Oswestry (function)	Pre-treatment, 6 weeks	VM improved all SF-36 subdomains, especially energy and physical function, vs. CG.
Altınbilek et al. (2023)	Multi-center, single-blind RCT	19–75	Chronic LBP	54	Total: 79 EG (40): VM + PT CG (39): Sham VM + PT	VAS (pain), ODI (function), BDI (depression)	Pre/post-treatment, 4 weeks post-treatment	VM + PT improved pain, function, and depression more than sham + PT ($p = 0.001$);
Fernández-López et al. (2021)	Single-blinded RCT pilot	18–65	Shoulder rotator cuff/myofascial pain	14	Total: 27 EG1 (9): Diaphragm VM EG2 (9): Ischemic compression CG (9): Breathing exercises	NPRS (pain), shoulder ROM, pressure pain threshold	Pre/post-treatment	VM and compression reduced pain and improved ROM more than breathing exercises ($p < 0.05$).
Ghillodia and Gandhi, 2020	Quasi-experimental pilot	30–60	Shoulder adhesive capsulitis	11	Total: 14 (single group, sequential placebo then VM)	SPADI (pain/disability), goniometer (ROM), sphygmomanometer (strength)	Pre/post-treatment	VM improved ROM, pain, and SPADI vs. placebo ($p < 0.05$). No strength changes.
De Oliveira Silva et al. (2018)	RCT pilot	22–28	Cervical pain with dyspepsia	15	Total: 28 EG (14): VM (stomach/liver) CG (14): Placebo VM	NPRS (pain), cervical ROM, EMG (trapezius)	Pre/post-treatment, 7 days	VM reduced pain and increased EMG amplitude vs. placebo ($p < 0.05$). No ROM difference.
Yangdol and Gandhi, 2021	Quasi-experimental pilot	51 (mean)	Cervical pain with forward head posture	3	Total: 5 EG: VM (pleural/pericardial) CG: Placebo VM	VAS (pain), posture screening, biofeedback, NDI	Pre/post-treatment	VM improved pain and posture vs. placebo ($p < 0.05$). No NDI or biofeedback changes.

NPRS = Numeric Pain Rating Scale; VAS = Visual Analog Scale; RMDQ = Roland-Morris Disability Questionnaire; ODI = Oswestry Disability Index; SPADI = Shoulder Pain and Disability Index; NDI = Neck Disability Index; ROM = Range of Motion; EMG = Electromyography; QoL = Quality of Life; EG = Experimental Group; CG = Control Group; VM = Visceral Manipulation; VMT = Visceral Manual Therapy; PT = Physical Therapy.

pain (nonspecific pain and forward head posture).

3.3. Methodological quality

Methodological quality varied (see Table 2). No studies achieved therapist blinding due to the manual nature of VMT. Five studies had assessor blinding, and three had subject blinding. Three studies (Mughal et al., 2019; Ghillodia and Gandhi, 2020; Yangdol and Gandhi, 2021) scored low (4/10 each) on the PEDro scale due to a lack of randomization or between-group statistical comparisons. Two studies (Santos et al., 2019; Fernández-López et al., 2021) scored moderately high (7/10 each), while two studies (Panagopoulos et al., 2015; De Oliveira Silva et al., 2018) achieved high scores (9/10 each), thereby enhancing the evidence quality.

3.4. Statistics

As a scoping review, no meta-analysis or inferential statistics were

Table 2
PEDro scores and level of evidence.

Study	Eligibility	Random Allocation	Allocation Concealed	Baseline Similarity	Subject Blinding	Therapist Blinding	Assessor Blinding	Key Outcome Measures	Intention-to-Treat	Between-Group Comparisons	Variability Measures	PEDro Score	CEBM Level
Mughal et al. (2019)	Yes	Yes	No	No	Yes	No	No	Yes	Yes	No	Yes	5/10	2b
Santos et al. (2019)	Yes	Yes	Yes	Yes	No	No	Yes	No	Yes	Yes	Yes	7/10	1b
Panagopoulos et al. (2015)	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9/10	1b
Tamer et al. (2017)	Yes	Yes	Yes	Yes	No	No	No	No	No	Yes	Yes	5/10	2b
Altınbilek et al. (2023)	Yes	Yes	No	Yes	No	No	No	No	No	Yes	Yes	5/10	2b
Fernández-López et al. (2021)	Yes	Yes	No	Yes	No	No	Yes	Yes	Yes	Yes	Yes	7/10	2b
Ghillodia and Gandhi, 2020	Yes	No	No	Yes	No	No	No	Yes	No	Yes	Yes	4/10	2c
De Oliveira Silva et al. (2018)	No	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	9/10	2b
Yangdol and Gandhi, 2021	Yes	No	No	No	No	No	No	Yes	Yes	Yes	Yes	4/10	2c

conducted due to study heterogeneity, to map evidence and highlight clinical implications rather than quantifying effect sizes.

3.5. Interventions

Interventions included VMT, encompassing SVM targeting specific organs (e.g., liver, diaphragm) or broader techniques (e.g., myofascial release, abdominal massage), applied alone or integrated with conventional PT (e.g., exercises, TENS, ultrasound), and compared to placebo (e.g., light touch) or standard PT.

Treatment details, including session number, duration, and targeted organs, are provided in Table 3. All studies used osteopathic-inspired SVM techniques that target specific organs, such as fascial release or organ glide. Treatment intensity ranged from a single session (n = 2) to 6–15 sessions over 2–6 weeks (n = 6), with VMT sessions lasting 5–15 min in most cases (n = 8).

Six studies likely incorporated osteopathic methods, such as Barral's SVM, targeting specific visceral structures, but none were exclusively osteopathic, often integrating PT techniques (e.g., exercises, manual therapy). Two studies (Mughal et al., 2019; Panagopoulos et al., 2015) leaned toward PT-based approaches with less explicit osteopathic influence.

3.6. Outcome measures

Primary and secondary outcome measures are detailed in Table 4. Pain was the primary outcome in nine studies, assessed using the Numeric Pain Rating Scale (NPRS) in four studies (Mughal et al., 2019; Panagopoulos et al., 2015; Fernández-López et al., 2021; De Oliveira Silva et al., 2018) and the Visual Analog Scale (VAS) in five studies (Santos et al., 2019; Tamer et al., 2017; Yangdol and Gandhi, 2021; Altınbilek et al., 2023; Ghillodia and Gandhi, 2020). Each study employed a single primary pain measure, ensuring consistent evaluation of pain outcomes across the trials.

3.7. Secondary outcomes included

- Range of Motion (ROM): Measured in three studies, with the Schober test used for lumbar mobility in one study (Santos et al., 2019), goniometers for shoulder ROM (Ghillodia and Gandhi, 2020), or inclinometers and goniometers for shoulder ROM (Fernández-López et al., 2021).
- Muscle Activation/Posture: Assessed in two studies, using electromyography (EMG) for trapezius muscle activation (De Oliveira Silva et al., 2018) and posture screening with biofeedback for forward head posture (Yangdol and Gandhi, 2021).
- Function/Disability: Evaluated in seven studies using scales such as the Roland-Morris Disability Questionnaire (RMDQ) (Panagopoulos et al., 2015; Santos et al., 2019), Oswestry Disability Index (ODI) (Tamer et al., 2017; Altınbilek et al., 2023), Neck Disability Index (NDI) (Yangdol and Gandhi, 2021), and Patient-Specific Functional Scale (Santos et al., 2019; Panagopoulos et al., 2015).
- Depression: Measured in one study using the Beck Depression Inventory (BDI) (Altınbilek et al., 2023).
- QoL: Measured in one study using the SF-36 (Tamer et al., 2017).

3.8. Efficacy of VMT

Results and statistical analyses are summarized in Table 5. Of the nine studies, eight reported significant pain reduction with VMT compared to placebo or standard PT (Mughal et al., 2019; Panagopoulos et al., 2015; Fernández-López et al., 2021; De Oliveira Silva et al., 2018; Yangdol and Gandhi, 2021; Santos et al., 2019; Tamer et al., 2017; Altınbilek et al., 2023; Ghillodia and Gandhi, 2020). Two studies reported pain reduction including pain within composite secondary outcomes (Ghillodia and Gandhi, 2020; via SPADI; Altınbilek et al., 2023,

Table 3
Description of treatments.

Study	Sessions	Duration	Experimental Group	Control Group
Mughal et al. (2019)	1	30 min	VM: Nonspecific techniques	Standard PT: Exercises, hot pack, ultrasound, strengthening
Santos et al. (2019)	5 (weekly)	PT: 40 min VM: 10 min	VM: Cardia, pylorus, Oddi, duodenojejunal/ileocecal valves, sigmoid, liver, hemodynamic manipulation PT: Spinal/pelvic/hip exercises	Placebo VM: Light touch PT: Same as EG
Panagopoulos et al. (2015)	1–12 (1–2/week, 6 weeks)	PT: 25–40 min VM: 5–10 min	VM: Fascial release, organ mobilization (thoracic/abdominal/pelvic) PT: Massage, exercises, ultrasound feedback	Placebo VM: Light touch PT: Same as EG
Tamer et al. (2017)	10 (2/week, 5 weeks)	30–40 min	VM: Thorax, lymphatic, liver, pelvic floor, and diaphragm techniques PT: Soft-tissue, manipulation, muscle energy Exercises: Spinal stabilization	PT + exercises (no VM)
Altınbilek et al. (2023)	15 PT (5/week, 3 weeks) 6 VM (2/week, 3 weeks)	PT: 65 min VM: 10–15 min	VM: Abdominal/pelvic organ mobilization, fascial release PT: Hot pack, TENS, ultrasound, therapeutic exercises	Sham VM: Light touch, no manipulation PT: Same as EG
Fernández-López et al. (2021)	1	10–15 min	VM: Diaphragm techniques	Ischemic compression or breathing exercises
Ghillodia and Gandhi, 2020	4 (2 placebo weeks 1–2, 2 VM weeks 3–4)	15 min	VM: Liver (coronal/transverse/sagittal manipulation)	Placebo VM: Flat touch epigastric, no movement
De Oliveira Silva et al. (2018)	1	VM: 5 min Placebo: 1 min	VM: Stomach and liver manipulation	Placebo VM: No tissue movement (umbilical region)
Yangdol and Gandhi, 2021	2 (1 placebo, 1 VM)	VM: 10 min Placebo: 1.5 min	VM: Pleural dome, pericardial ligaments	Placebo VM: Hands on sternum, no movement

VM = Visceral Manipulation (organ-specific techniques); VMT = Visceral Manual Therapy (broader manual interventions); PT = Physical Therapy; EG = Experimental Group; CG = Control Group.

via VAS/ODI/BDI). Pain reductions often exceeded minimal clinically important differences (MCID) (NPRS ≥2 points, VAS ≥1.5–2 cm), based on significant p-values and reported mean differences. Five studies showed short-term pain relief (1–7 days), and one demonstrated long-term relief (52 weeks). Santos et al. (2019) found no significant difference in pain between groups.

Table 4
Outcome measures and adverse events.

Study	Primary Outcome	Secondary Outcomes	Adverse Effects
Mughal et al. (2019)	NPRS (pain)	Sitting-Rising Test (mobility)	None reported
Santos et al. (2019)	VAS (pain)	Schober Test (lumbar mobility), RMDQ (function), Patient-Specific Functional Scale	Muscle soreness and fatigue in both groups
Panagopoulos et al. (2015)	NPRS (pain at 6 weeks)	NPRS (2, 52 weeks), RMDQ (function), Patient-Specific Functional Scale	None reported
Tamer et al. (2017)	VAS (pain)	SF-36 (QoL), ODI (function)	None reported
Altınbilek et al. (2023)	VAS (pain)	ODI (function), BDI (depression)	None reported
Fernández-López et al. (2021)	NPRS (pain)	Shoulder ROM, pressure pain threshold	None reported
Ghillodia and Gandhi, 2020	SPADI (pain/disability)	Shoulder ROM, sphygmomanometer (strength)	None reported
De Oliveira Silva et al. (2018)	NPRS (pain)	Cervical ROM, EMG (trapezius)	None reported
Yangdol and Gandhi, 2021	VAS (pain)	Posture screening, biofeedback, NDI	None reported

NPRS = Numeric Pain Rating Scale (0–10 scale assessing pain intensity); VAS = Visual Analog Scale (100-mm line for pain intensity); RMDQ = Roland-Morris Disability Questionnaire (24-item scale for low back pain disability); ODI = Oswestry Disability Index (10-item scale for low back pain disability); SPADI = Shoulder Pain and Disability Index (13-item scale for shoulder pain and function); NDI = Neck Disability Index (10-item scale for neck pain disability); ROM = Range of Motion; EMG = Electromyography (measures muscle electrical activity); QoL = Quality of Life; SF-36 = 36-Item Short Form Survey (measures health-related QoL).

Three studies reported improved ROM (e.g., lumbar mobility in Mughal et al., 2019, shoulder flexion in Fernández-López et al., 2021; Ghillodia and Gandhi, 2020), but one cervical pain study (De Oliveira Silva et al., 2018) showed no effect.

Function/disability improved in five studies, as measured by scales such as the ODI, RMDQ, or SPADI (Santos et al., 2019; Tamer et al., 2017; Altınbilek et al., 2023; Ghillodia and Gandhi, 2020), although general function results were inconsistent (e.g., Panagopoulos et al., 2015 showed no difference).

Two studies on cervical pain yielded mixed outcomes regarding muscle activation and posture: De Oliveira Silva et al. (2018) reported increased trapezius EMG amplitude, whereas Yangdol and Gandhi (2021) noted improved posture but no changes in muscle activation. Tamer et al. (2017) found enhanced QoL (as measured by SF-36), and Altınbilek et al. (2023) reported improved depression (as measured by BDI).

3.9. Adverse events

No serious adverse events were reported (see Table 4). Santos et al. (2019) reported that muscle soreness and fatigue, observed in both the SVM and control groups, were likely related to the exercise component of the physiotherapy protocol, with no systematic adverse event data collected. Systematic safety reporting remained limited across the studies.

4. Discussion

This scoping review provides moderate evidence that VMT, including SVM, reduces chronic musculoskeletal pain, with eight of nine studies demonstrating significant pain relief compared to placebo or

Table 5
Results and statistics.

Study	Immediate (Primary/ Secondary)	Short-Term (Primary/ Secondary)	Long-Term (Primary/ Secondary)	Statistics
Mughal et al. (2019)	Pain: EG > CG (within-group $p < 0.0001$) Mobility: EG > CG (within-group $p < 0.0001$)	Pain: EG > CG (within-group $p < 0.0001$) Mobility: EG > CG (within-group $p < 0.0002$	–	Paired T-test (within-group); no between-group analysis reported.
Santos et al. (2019)	Pain: Both groups improved ($p < 0.0001$)	Pain: No difference ($p = 0.642$) Mobility: EG > CG ($p = 0.002$), Function: EG > CG ($p = 0.008$)	–	Two-way ANOVA, Bonferroni correction
Panagopoulos et al. (2015)	Pain/ Function: No difference ($p = 0.898$)	–	Pain: EG > CG ($p = 0.015$) Function: No difference	Linear mixed models, $p < 0.05$ (primary), $p < 0.01$ (secondary)
Tamer et al. (2017)	Pain/QoL: EG > CG ($p < 0.05$)	–	–	Wilcoxon (within-group), Mann-Whitney U (between-group)
Altınbilek et al. (2023)	Pain/ Function/ Depression: EG > CG ($p < 0.001$)	Pain/ Function/ Depression: EG > CG ($p < 0.001$)	–	ANOVA/ Mann-Whitney U
Fernández-López et al. (2021)	Pain/ROM: VM > breathing ($p < 0.05$)	–	–	ANOVA, Scheffé/ Tamhane's test
Ghillodia and Gandhi, 2020	Pain/ROM/ Disability: VM > placebo ($p < 0.05$)	–	–	Paired T-test, Wilcoxon test
De Oliveira Silva et al. (2018)	Both reduced pain (no between-group diff), EMG VM > placebo ($p < 0.001$) ROM: No difference	Pain: VM > placebo ($p < 0.05$)	–	ANOVA, post-hoc tests
Yangdol and Gandhi, 2021	Pain/ Posture: VM > placebo ($p < 0.05$)	–	–	Wilcoxon signed-rank test

EG = Experimental Group; CG = Control Group; VM = Visceral Manipulation (organ-specific techniques); VMT = Visceral Manual Therapy (broader manual interventions); ROM = Range of Motion; QoL = Quality of Life; NPRS = Numeric Pain Rating Scale; VAS = Visual Analog Scale; EMG = Electromyography. See Table 4 for additional outcome measure definitions (e.g., RMDQ, SPADI).

standard PT (Table 5). As outlined in the Introduction, VMT likely alleviates pain by addressing visceral-somatic interactions, such as fascial restrictions or central sensitization. Pain reductions, consistently exceeding the MCID thresholds on the NPRS (≥2 points) or VAS (≥1.5–2 cm), underscore the clinical relevance of SVM, particularly for LBP with visceral comorbidities (Panagopoulos et al., 2015; Altınbilek et al., 2023). However, Santos et al. (2019) found no significant reduction in pain ($p = 0.642$), raising questions about the consistency of SVM's efficacy across diverse protocols and populations.

Beyond pain relief, improvements in lumbar mobility and specific function (Santos et al., 2019), enhanced function and relief from depression (Altınbilek et al., 2023), suggest that VMT has broader benefits. However, inconsistent results for ROM and muscle activation, particularly in cervical pain studies (De Oliveira Silva et al., 2018; Yangdol and Gandhi, 2021), stem from the use of varied protocols (e.g., liver vs. diaphragm manipulation) and outcome measures.

Comprehensive patient assessments to identify visceral dysfunction are critical, though challenges persist. Guillaud et al. (2018) reported poor reliability of visceral osteopathy diagnostics (kappa values ranging from 0.11 to 0.55), highlighting the need for improved diagnostic tools. Building on these limitations, Eguaras et al. (2019) demonstrated benefits from a standardized visceral protocol for gastroesophageal reflux disease, with secondary improvements in musculoskeletal function. However, its small sample size ($n = 60$) and non-musculoskeletal focus limit its applicability. Ceballos-Laita et al. (2024) noted modest pain benefits (SMD = −0.36) with low certainty, reflecting methodological variability in osteopathic manipulative treatment studies.

4.1. Subgroup analysis

Studies on LBP ($n = 5$) showed consistent pain reduction, whereas studies on the shoulder ($n = 2$) and cervical spine ($n = 2$) had mixed outcomes in terms of ROM and muscle activation, likely due to variations in protocols.

Studies with visceral comorbidities ($n = 2$, e.g., gastrointestinal disorders in Panagopoulos et al., 2015; dyspepsia in De Oliveira Silva et al., 2018) yielded mixed results compared to those with musculoskeletal pain alone ($n = 7$). Studies without comorbidities (e.g., Mughal et al., 2019; Altınbilek et al., 2023) demonstrated consistent pain reduction and secondary improvements (e.g., ROM, ODI), with slightly higher methodological quality. In contrast, studies involving comorbidities yielded less consistent outcomes, possibly due to complex interactions between the visceral and somatic systems, underscoring the need for tailored assessments despite preliminary evidence.

4.2. Mechanisms and safety

The placebo effect from therapeutic touch may contribute to short-term pain relief (Testa and Rossettini, 2016). However, the long-term benefits, as observed in Panagopoulos et al. (2015) at 52 weeks, suggest sustained physiological effects, albeit limited by the single study. No serious adverse events were reported, with Santos et al. (2019) noting only exercise-related muscle soreness and fatigue in both groups. However, the lack of systematic safety reporting across studies remains a critical gap, necessitating the standardization of monitoring in future trials to ensure safety.

4.3. Clinical integration

Clinicians should assess for visceral dysfunction using a patient's history (e.g., gastrointestinal complaints, prior surgeries) and physical findings, such as fascial tension; however, current diagnostic accuracy remains limited (Guillaud et al., 2018). Specialized training in visceral manipulation techniques (typically 20–40 h) is recommended and should be more widely integrated into physical therapy education and continuing professional development.

Evidence suggests VMT may be particularly beneficial for patients with visceral comorbidities such as IBS or dyspepsia (Panagopoulos et al., 2015). However, its broader implementation is hindered by insufficient therapist training and the absence of structured curricula. While promising results have been reported (e.g., Panagopoulos et al., 2015; Altınbilek et al., 2023), studies often suffer from methodological

limitations, including small cohorts and inadequate blinding.

Future research should focus on large-scale randomized trials with standardized protocols, validated clinical outcomes (e.g., NPRS, VAS, RMDQ, ODI, BDI), and extended follow-up periods to determine the long-term efficacy and cost-effectiveness of this approach. Populations with visceral comorbidities, particularly those contributing to low back pain, should be prioritized, as current evidence remains scarce.

5. Limitations

The review has several limitations. Low PEDro scores (4/10) in three studies (Mughal et al., 2019; Ghillodia and Gandhi, 2020; Yangdol and Gandhi, 2021) due to a lack of randomization or blinding weaken the strength of the conclusions, particularly for cervical and shoulder pain outcomes, necessitating cautious interpretation. Small sample sizes (ranging from 5 to 79 participants) limit generalizability, even with the inclusion of a relatively larger study by Altınbilek et al. (2023).

The scoping review design, while broad, lacks the rigor of a systematic review, resulting in a reduced depth of quantitative synthesis. Excluding non-English studies and relying on Google Scholar may introduce publication bias, potentially overlooking relevant international research.

Poor adverse event reporting across all studies, with only Santos et al. (2019) noting minor exercise-related soreness and fatigue, hinders a comprehensive safety assessment.

Furthermore, most studies focused on SVM, with limited exploration of other visceral interventions (e.g., abdominal massage, myofascial release) for musculoskeletal disorders, and the inclusion of depression as a new outcome (Altınbilek et al., 2023) remains underexplored in this context.

6. Recommendations for future research

Future research should focus on large-scale RCTs with sample sizes ≥100 to enhance generalizability, addressing the small samples (5–79 participants) in studies like Santos et al. (2019) and the variability across the current set, despite the larger cohort in Altınbilek et al. (2023, n = 79). Standardized VMT protocols are necessary to reduce heterogeneity, targeting specific organs such as the liver or intestines, as demonstrated in Santos et al. (2019) and Ghillodia and Gandhi (2020), to enhance consistency.

Across the reviewed studies, the duration of visceral manual therapy was notably brief, typically ranging from 5 to 15 min per session, with some interventions involving a single 1 min treatment of a specific organ. Such short treatment durations may partly explain the nonsignificant or inconsistent outcomes reported in several trials. It is therefore recommended that future studies allocate longer and more consistent intervention times to adequately assess the therapeutic potential and cumulative effects of visceral manipulation techniques.

Validated outcome measures, including NPRS, VAS, RMDQ, ODI, and BDI, should be paired with objective tools like ultrasound for visceral mobility or goniometry for ROM to improve reliability.

To build on VMT's historical evolution from its osteopathic roots to interdisciplinary applications, future developments could incorporate technological advancements, such as real-time imaging (e.g., ultrasound or MRI), to assess visceral mobility pre- and post-treatment, thereby enhancing diagnostic reliability (Guillaud et al., 2018). Educational prospects include integrating VMT into physical therapy and osteopathic curricula and standardized training programs to address current gaps in therapist preparation. Clinically, integration could involve hybrid protocols combining VMT with digital health tools (e.g., tele-rehabilitation for follow-up) and cost-effectiveness studies to support adoption in diverse healthcare settings, particularly for patients with visceral comorbidities.

Given their relevance in two LBP studies, populations with visceral comorbidities, such as irritable bowel syndrome, should be prioritized (Panagopoulos et al., 2015; De Oliveira Silva et al., 2018). Long-term follow-ups (≥6 months), as demonstrated by Panagopoulos et al. (2015) at 52 weeks, will help clarify the durability of the effects. Despite no serious adverse events being reported across all studies, systematic adverse event reporting remains critical to confirm VMT's safety, particularly with the limited data beyond Santos et al. (2019).

Cost-effectiveness analyses, considering training costs, and mechanistic studies exploring visceral-somatic pathways will support clinical adoption and provide theoretical grounding for its use.

7. Clinical relevance

- VMT significantly reduces chronic musculoskeletal pain, enhancing patient outcomes in physical therapy.
- Screening for visceral dysfunction optimizes VMT application for low back, shoulder, and cervical pain.
- Combining VMT with conventional PT improves pain relief and functional recovery, but standardization is needed.
- Therapist training in VMT is essential for effective clinical integration due to its specialized nature.

8. Conclusion

VMT shows promise as an adjunctive therapy for musculoskeletal pain, warranting its integration into clinical practice through targeted visceral assessments and therapist training. To identify suitable candidates, clinicians should prioritize screening for visceral dysfunction, including gastrointestinal conditions and a history of abdominal or pelvic surgery.

Future research should focus on large-scale RCTs with standardized VMT protocols, validated outcome measures, and long-term follow-ups to confirm efficacy and cost-effectiveness. Special consideration is needed for patients with coexisting musculoskeletal and visceral conditions, such as fibromyalgia and irritable bowel syndrome. Addressing these gaps will position VMT as a cornerstone of evidence-based musculoskeletal pain management, enhancing patient outcomes and QoL.

CRediT authorship contribution statement

Mila Goldenberg: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Ricki Dahan Cohen:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Data curation, Conceptualization. **Leonid Kalichman:** Writing – review & editing, Supervision, Project administration, Methodology, Formal analysis, Conceptualization.

Declaration of generative AI and AI-assisted technologies in the writing process

While preparing this work, the authors utilized Grammarly and Grok 3, an AI tool developed by xAI, to assist with revising the manuscript text and enhancing grammar and style. The content and interpretations were author-generated. After using these tools, the authors reviewed and edited the content as needed, taking full responsibility for the publication's content.

Declaration of competing interest

The authors, Mila Goldenberg, Ricki Dahan Cohen and Leonid Kalichman, declare no conflicts of interest. There are no financial, personal, or professional relationships with other people or organizations that could inappropriately influence or bias the content of this manuscript.

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