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Review article

Clinical features of manual therapy interventions in people with tension-type headache: A scoping review

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ABSTRACT

Background: Tension-type headache is the most prevalent primary headache, often managed with manual therapy. However, intervention protocols vary widely, and the clinical rationale is often unclear.
Objective: This scoping review aimed to map the characteristics of manual therapy interventions applied in randomized controlled trials for tension-type headache.
Methods: A comprehensive search was conducted across PubMed, Embase, Scopus, and Web of Science. The last search was performed on September 14, 2025. The protocol was prospectively registered in the Open Science Framework (OSF registration: https://osf.io/w7xs5). Trials involving manual therapy for adults with tension-type headache were included. Data were extracted on intervention type, dosage, target structures, therapist background, and outcomes.
Results: Thirty-three trials involving 1852 participants were included. Manual therapy techniques ranged from spinal manipulation and myofascial release to suboccipital inhibition and friction massage. Treatment dosage varied considerably in frequency and duration. Most studies targeted cervical or suboccipital structures, with few addressing temporomandibular or postural components. Considerable variability was also observed in outcome measures.
Conclusion: The review highlights the diversity of manual therapy techniques, targeted structures, treatment dosages, and therapist backgrounds in the management of tension-type headache. The heterogeneity and limited mechanistic rationale in the included studies restrict interpretability. Future research should focus on mechanism-informed, individualized interventions with standardized reporting.

1. Introduction

Tension-type headache (TTH) is the most prevalent primary headache disorder, affecting between 26% and 38% of the global population, and representing approximately 60–78% of all primary headache cases reported in epidemiological studies [Stovner et al., 2007; Dowson, 2015]. This high prevalence makes TTH a major public health challenge, given its associated disability and substantial economic burden [Meng and Sui, 2024]. In addition to its significant impact on quality of life, TTH interferes with daily activities, reduces work productivity, and increases the risk of analgesic overuse [Zwart et al., 2004; Coeytaux and Linville, 2007]. The relatively low rate of healthcare consultation observed in this population may be explained by insufficient information regarding the effectiveness of conservative treatments or by previous negative healthcare experiences [Rasmussen, 2001].

TTH is a clearly defined clinical entity within the International Classification of Headache Disorders (ICHD-3), which differentiates episodic (infrequent and frequent) from chronic forms based on frequency and symptom profile [IHS, 2018]. However, some debate persists regarding the sensitivity and specificity of its diagnostic criteria, particularly because signs and symptoms may overlap with other headache types, such as migraine, in real-world clinical settings [Blumenfeld and Siavoshi, 2018]. According to ICHD-3, TTH is characterized by bilateral location, pressing or tightening quality,

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mild-to-moderate intensity, and duration from minute to days. It is not typically aggravated by routine physical activity, and although nausea, photophobia, or phonophobia may occur, they are not predominant symptoms. The frequent overlap of these features with those of other primary headaches contributes to variability in diagnosis across studies.

Despite its high prevalence, the etiology and underlying mechanisms of TTH remain incompletely understood [Jensen, 2018]. One hypothesis proposes that nociceptive input from the cervical spine may influence TTH symptoms through convergence in the trigeminocervical nucleus [Anarte-Lazo et al., 2021]; In this nucleus, nociceptive inputs coming from upper cervical structures, specifically from C1-C3 segments, converge with second-order neurons receiving also afferents from the first division of the trigeminal nerve [Bogduk, 2001]. Thus, theoretically, every structure innervated by the upper cervical spine and the trigeminal nerve may potentially lead to referral pain to the head [Bolton et al., 2005]. Therefore, it has been argued that manual therapy, through neurophysiological effects, may be another tool in the management of TTH. However, TTH remains a primary headache disorder distinct from cervicogenic headache, which is a secondary headache caused by cervical spine pathology [Fernández-de-Las-Peñas et al., 2023].

Based on these pathophysiological considerations, the management of TTH includes both pharmacological and non-pharmacological therapies. Among non-pharmacological options, manual therapy has demonstrated a favorable safety profile and has shown cost-effectiveness in certain clinical contexts. However, findings regarding its clinical effectiveness—particularly when used as a stand-alone treatment—remain inconsistent, and the evidence continues to be controversial [Watson and Drummond, 2012; Mesa-Jiménez et al., 2015; Côté et al., 2019; Satpute et al., 2025].

Despite the growing body of evidence from randomized controlled trials and previous reviews examining manual therapy interventions specifically for TTH, there remains substantial heterogeneity in treatment protocols, including differences in the techniques used, targeted anatomical structures, dosage, and outcome measures.

This variability complicates the interpretation and translation of research findings into clinical practice. Furthermore, many studies lack detailed descriptions of the underlying pathophysiological mechanisms, limiting the understanding of how manual therapy exerts its effects. Moreover, the frequent absence of a clearly articulated mechanistic rationale in many studies likely contributes to the heterogeneity observed across manual therapy protocols, further underscoring the need to systematically map these interventions.

Several previous reviews have examined manual therapy, or physical therapy approaches for TTH; however, these works have typically focused on specific techniques, included mixed headache populations, or provided broad clinical overviews rather than detailed analyses of intervention characteristics [Watson and Drummond, 2012; Lu et al., 2024; Côté et al., 2019; Bendtsen et al., 2016]. Moreover, existing systematic reviews frequently report inconsistent findings, in part due to marked variability in the manual therapy protocols used across studies—differences in techniques, targeted structures, dosage, and outcome measures. These gaps make it difficult to interpret the effectiveness of manual therapy or to translate findings into clinical practice. Therefore, a scoping review is warranted to systematically map the range of manual therapy modalities implemented in randomized controlled trials for TTH and to clarify sources of heterogeneity in the current evidence base.

This scoping review aimed to map the characteristics of manual therapy interventions applied in randomized controlled trials conducted in clinical, healthcare, or hospital settings involving adults diagnosed with TTH. In particular, we sought to summarize the clinical characteristics and key components of these interventions, to help clarify sources of heterogeneity across studies and to provide clinicians with an organized overview of manual therapy approaches used in the management of TTH.

2. Methods

The protocol for this scoping review was registered in the Open Science Framework on September 11, 2025, with the following DOI/ID: https://osf.io/w7xs5. No amendments have been made to the protocol since registration. This scoping review followed the Arksey and O'Malley framework [Arksey and O'Malley, 2005], enhanced by Levac et al.'s methodological guidance [Levac et al., 2010]. Reporting adhered to the PRISMA extension for Scoping Reviews (ScR) checklist [Tricco et al., 2018].

2.1. Research questions

The primary research question of this scoping review was:

What are the intervention characteristics of manual therapy for the treatment of TTH in adults?

2.2. Eligibility criteria

Eligibility criteria, combining both inclusion and exclusion criteria, were defined following the Participant-Concept-Context (PCC) framework [Tricco et al., 2018]:

Population (P): Adults diagnosed with primary TTH according to ICHD-3, ICHD-2, or studies using clearly defined criteria equivalent to TTH.

Concept (C): Manual therapy interventions, including techniques, targeted structures, dosage, and key components. Manual therapy was defined as interventions applied manually to musculoskeletal structures, including spinal manipulation, joint mobilization, soft tissue techniques, and myofascial trigger point release.

Context (C): Randomized controlled trials conducted in clinical, healthcare, or hospital settings.

Inclusion criteria: articles involving adults with primary TTH according to the ICHD-3, ICHD-2, or studies using clearly defined criteria equivalent to TTH [7]; studies evaluating the use of manual therapy techniques as primary treatment, or as adjunctive treatment when manual therapy was the main component; studies reporting detailed intervention parameters; RCTs; articles published in English or Spanish. Manual therapy was defined as interventions applied manually to musculoskeletal structures, including spinal manipulation, joint mobilization, soft tissue techniques, and myofascial trigger point release.

Exclusion criteria: we excluded those articles not specifying the features of the manual therapy intervention; studies in which TTH was merged with other headache conditions without separate data; studies where manual therapy was combined with non-manual interventions (e.g., exercise, pharmacological, electrotherapy, acupuncture) and the contribution of manual therapy could not be determined; other study types than RCTs; articles published in other language than English or Spanish.

2.3. Information sources

Articles were retrieved in different databases: PubMed, Embase, Scopus and Web of Science. The database search was conducted between September 12, 2025, and September 14, 2025, covering all available records from database inception to the final search date. In addition, reference lists of included studies were hand-searched for potential articles of interest.

2.4. Search strategy

A tailored strategy in agreement of all authors was performed through combination of different terms, adapting these according to each database. Although the search strategy included specific mechanistic terms such as 'myofascial pain syndromes' and 'trigger points', these were intentionally combined with broader manual therapy

descriptors (e.g., manual therapy', mobilization', manipulation') to ensure comprehensive retrieval of studies targeting a wide range of therapeutic mechanisms beyond myofascial components.

No publication date limits were applied; all databases (PubMed, Embase, Scopus, and Web of Science) were searched from their inception to September 14, 2025.

An example of the search strategies performed in each database is provided in Appendix 1.

2.5. Study selection

Records retrieved from all databases were first deduplicated using

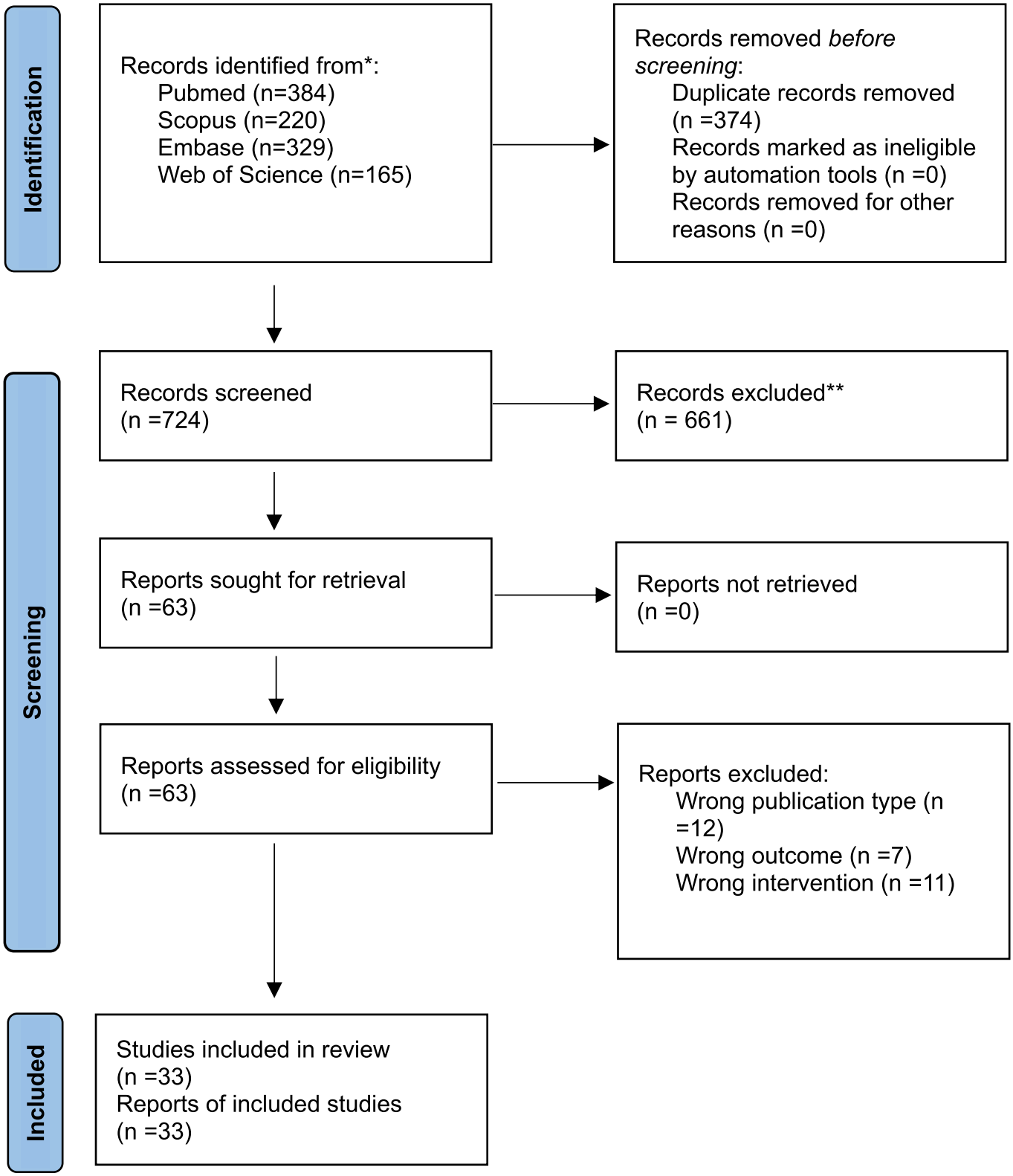

Fig. 1. Flowchart of the selection procedure.

Rayyan, followed by manual verification to ensure all duplicates were removed. Two reviewers (EA and EG) then independently screened titles and abstracts. In case of disagreement, they discussed it and, if agreement was not achieved, a third reviewer (CB) made the final decision. The same procedure was followed for the full texts, applying the predefined inclusion and exclusion criteria to ensure consistency and minimize selection bias.

2.6. Data extraction and data charting

A data extraction sheet was developed in consensus by all authors. Data was extracted by one reviewer (AB) and checked by another (EA). Disagreement was resolved by a third reviewer (CR). Data extracted included: a) study and participant characteristics (author, year, sample size, gender, age, diagnostic criteria; b) interventions characteristics: headache features (modality, position of the patient, number of sessions, number of series, duration of series, structure treated, general results, adverse events or unwanted reactions.

2.7. Data synthesis

Since the goal of a scoping review is not to quantitatively analyze the data, but to map the concepts underlying the research question, we performed a narrative synthesis of the findings, in line with the screening and extraction datasheet. All authors discussed and agreed on the final reporting of results, subgrouping on different sub-questions.

3. Results

Database search and manual searching of specific journals resulted in a total of 1098 articles. After removing duplicates, 724 articles remained. Titles/abstract screening resulted in a total of 63 eligible articles. After full-text assessment, 33 articles were included in this review. A flow diagram of the selection procedure can be found on Fig. 1. In total, among all the included studies, 1852 participants were involved.

3.1. Study and participants characteristics

Among the included studies, sample sizes ranged from as few as 20 participants [Vernon et al., 2009] to studies with over 152 subjects [Álvarez-Melcón et al., 2018]. Gender distribution was predominantly female (75%), with some studies, such as that by Satpute et al. [Satpute et al., 2025], conducted exclusively on female participants. The mean age of participants ranged from 20 to 54 years, with the youngest sample reported by Álvarez-Melcón et al. [Álvarez-Melcón et al., 2018], and the oldest by Georgoudis et al. [Georgoudis et al., 2018].

The diagnosis of primary TTH in most participants was made according to the ICHD [IHS, 2018] criteria provided by the International Headache Society. Some studies also applied specific diagnostic criteria related to myofascial trigger points (TrPs), including referred pain, the presence of taut bands, and jump sign [Kamali et al., 2019].

The diagnosis of TTH in the included studies was based on different versions of the ICHD or earlier IHS criteria [IHS, 2018]. According to ICHD-2, diagnosis required at least 10 episodes of headache lasting 30 min to 7 days, with at least two of the following features: bilateral location, pressing or tightening quality, mild or moderate intensity, and not aggravated by routine physical activity; additionally, nausea or vomiting had to be absent, and photophobia or phonophobia either absent or limited to one symptom. The ICHD-3 beta and ICHD-3 (2013 and 2018, respectively) retained similar core features but clarified that only mild nausea or one of photophobia or phonophobia may be present and emphasized that headaches must not be better accounted for by another diagnosis. Some studies also applied additional diagnostic criteria for TrPs, including referred pain, presence of taut bands, and the jump sign [Kamali et al., 2019]. The study and participants characteristics can be found in Supplementary Material S1.

3.2. Interventions characteristics

Spinal manipulation was the most frequently used manual therapy [Anderson and Seniscal, 2006; Bove and Nilsson, 1998; Corum et al., 2021; Deodato et al., 2019; Espí-López and Gomez- Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016b; Espí-López et al., 2016c; Rolle et al., 2014; Romero Morales et al., 2015; Vernon et al., 2009], in which the authors applied high-velocity, low-amplitude movements. In this modality, most authors reported positioning patients in the supine position [Espí-López and Gomez- Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016b; Espí-López et al., 2016c], with the suboccipital area being the most treated region [Espí-López and Gomez-Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016b; Vernon et al., 2009].

Another widely used manual technique was friction massage [Azhdari et al., 2023; Bove and Nilsson, 1998; Chatchawan et al., 2014; Damapong et al., 2015; Espí-López et al., 2016b; Kamali et al., 2019; van Ettekoven and Lucas 2006; Vernon et al., 2009] applied mainly to the cervical area except for one study [Kamali et al., 2019]. Other frequently employed techniques included soft tissue inhibition [Elgendy et al., 2024; Espí-López and Gomez-Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016c; Ferragut-Garcías et al., 2017; Pérez-Llanes et al., 2022; Shafiq et al., 2023] and myofascial trigger point release [Berggreen et al., 2012; Elgendy et al., 2024; Espí-López et al., 2014a,b; Espi-Lopez et al., 2022; Moraska et al., 2017; Moraska et al., 2018; Romero Morales et al., 2015; Shafiq et al., 2023; Sharifi-Razavi et al., 2021]. Additional methods used were spinal mobilization [Azhdari et al., 2023; Castien et al., 2011; Elgendy et al., 2024; van Ettekoven and Lucas, 2006], postural correction [Álvarez-Melcón 2018; Castien et al., 2011; van Ettekoven and Lucas 2006], and myofascial release [Ajimsha MS 2011; Azhdari et al., 2023; Corum et al., 2021; Georgoudis et al., 2018; Moraska et al., 2017].

Most authors provided detailed descriptions of the techniques used, often including explanatory images [Azhdari et al., 2023; Berggreen et al., 2012; Damapong et al., 2015; Espi-Lopez et al., 2022; Ferragut-Garcías et al., 2017; Moraska et al., 2017; Sharifi-Razavi et al., 2021; Shafiq et al., 2023; van Ettekoven and Lucas, 2006]. However, only two studies did not describe their methodology, as their studies were based on individualized treatments tailored to each participant's needs [Rolle et al., 2014; Deodato et al., 2019].

Many authors also indicated that the professional responsible for delivering the treatment was a specialized physiotherapist [Ajimsha MS, 2011; Álvarez-Melcón et al., 2018; Azhdari et al., 2023; Bove and Nilsson, 1998; Castien et al., 2011; Chatchawan et al., 2014; Corum et al., 2021; Deodato et al., 2019; Damapong et al., 2015; Espí López and Gomez-Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016b; Espí-López et al., 2016c; Espi-Lopez et al., 2022; Ferragut-García et al., 2017; Georgoudis et al., 2018; Moraska et al., 2017; Moraska et al., 2018; Mohamadi et al., 2020; Shafiq et al., 2023; Satpute et al., 2025; van Ettekoven and Lucas, 2006], most of whom had 10 years of experience [Castien et al., 2011; Espí-López and Gómez-Conesa, 2014; Espí-López et al., 2014a,b; Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016c; Shafiq et al., 2023]. Some even underwent manual therapy training prior to the intervention [Ajimsha MS, 2011; Azhdari et al., 2023; Castien et al., 2011; Chatchawan et al., 2014; Georgoudis et al., 2018; Moraska et al., 2018; van Ettekoven and Lucas, 2006].

The number of treatment sessions varied widely, ranging from a single session [Moraska et al., 2018] to 28 sessions [Álvarez-Melcón et al., 2018], with each session lasting between 15 and 45 min in most studies. The frequency of sessions also varied, typically over a period of 4 to 6 weeks, ranging from once a week to several sessions per week.

The outcomes assessed across the included studies primarily related

to headache characteristics, pain sensitivity, and psychological variables. Headache frequency and intensity were the most commonly reported measures. Pain sensitivity was frequently evaluated using pressure pain threshold assessed with an algometer [Bove and Nilsson, 1998; Corum et al., 2021]. Some studies also included psychological outcomes associated with headache, such as stress or emotional symptoms [Espí-López et al., 2014b; Espí-López et al., 2016a,b,c; Espí-López et al., 2016c]. While most outcomes were measured in the short term immediately after the intervention period, a smaller number of studies incorporated longer follow-up assessments, such as the 26-week follow-up reported by Castien et al. [Castien et al., 2011].

Overall, the interventions were well tolerated. Some studies reported mild adverse effects such as pain, discomfort, or post-treatment fatigue, but no serious adverse events were observed. In specific cases, participants experienced temporary or mild discomfort in muscles or joints, which generally resolved quickly.

Although the aim of this scoping review was to map the characteristics of manual therapy interventions rather than determine comparative effectiveness, several recurring elements were observed among interventions that reported positive clinical changes. High-velocity, low-amplitude spinal manipulation, particularly applied in the supine position and targeting the suboccipital region, was one of the most commonly used approaches across studies. Friction massage and soft tissue inhibition were also frequently employed, primarily directed to cervical musculature, along with myofascial trigger point release in muscles such as the suboccipitals, upper trapezius, sternocleidomastoid, or cervical paraspinals. In addition to these techniques, several studies incorporated spinal mobilization, myofascial release, or postural correction. Across interventions, treatment was typically delivered by experienced physiotherapists, often with more than 10 years of clinical practice or specific manual therapy training. Session dosage commonly ranged from 15 to 45 min, applied one to two times per week over 4 to 6 weeks, although substantial variability existed. While these patterns cannot be interpreted as markers of superior efficacy, they provide a descriptive synthesis of elements that recurrently appeared in studies reporting improvements in headache frequency, intensity, or pain sensitivity.

Regarding reproducibility, approximately 85% of the interventions were considered replicable, as they provided detailed descriptions of the procedures, including patient positioning, target muscles, duration, number of repetitions or sessions, and often included visual aids, making replication feasible. In contrast, around 15% of interventions were not considered reproducible, usually because they were highly individualized, lacked clear procedural descriptions, or relied heavily on clinician judgment and experience. The interventions characteristics can be found in Supplementary Materia S2.

4. Discussion

This scoping review provides a comprehensive overview of the clinical characteristics of manual therapy interventions used in RCTs for people with tension-type headache TTH. To our knowledge, this is the first review to systematically map the diversity in intervention types, targeted anatomical structures, therapist expertise, treatment dosage, and outcomes assessment across a broad range of manual therapy trials in this population. By highlighting both the breadth of therapeutic strategies and the substantial heterogeneity in the literature, our review identifies important gaps that limit interpretation and translation into clinical practice.

A central finding of this review is the wide variability in the types of manual therapy employed. Techniques ranged from high-velocity low-amplitude spinal manipulation, soft tissue mobilization, and myofascial release to suboccipital inhibition and postural correction. Each technique is described as addressing different anatomical regions, from deep cervical joints to superficial musculature or myofascial areas, reflecting diverse conceptual frameworks proposed by the study authors. This heterogeneity in therapeutic approaches and underlying rationales indicates that the current evidence base remains unclear and does not support a consistent or unified clinical framework for the use of manual therapy in TTH.

Some studies justified cervical mobilization with reference to the trigeminocervical convergence theory [Watson and Drummond, 2012], while others referred to myofascial trigger point models in cranio-cervical muscles grounded in muscle nociception or central sensitization frameworks [Fernández-de-Las-Peñas et al., 2006]. However, these theoretical frameworks were not consistently supported by direct mechanistic evidence within the included trials, and the actual physiological pathways underlying clinical effects remain uncertain. None of the included studies clearly explained the specific mechanisms by which the interventions might exert their effects. Consequently, no single technique emerges from the current evidence as a clearly established reference approach. This limitation compromises the transferability of these interventions to routine clinical physiotherapy practice.

Another notable finding is the lack of standardization in treatment dosage and outcomes assessment. The number of sessions varied from one to 28, and session duration ranged from 15 to 45 min. Similarly, outcome measures were inconsistently reported, with some studies focusing solely on headache frequency and intensity, while others included pain pressure thresholds, range of motion, or psychological variables. Only 4 studies (12%) included follow-up periods beyond six weeks, limiting understanding of long-term effects. These gaps highlight the need for research that establishes optimal dosage, uniform outcome measures, and long-term efficacy.

Additionally, 30 out of 33 studies (91%) implemented standardized protocols rather than individualized treatments, with only 3 studies (9%) adapting therapy based on patient-specific findings such as the presence of active myofascial trigger points or cervical joint hypomobility. This limited degree of individualization restricts the clinical applicability of results, particularly given the known heterogeneity of TTH presentations and the multifactorial mechanisms involved. It has been suggested that manual therapy interventions might benefit from greater consideration of individual clinical characteristics, including patterns of muscular hypertonicity, cervical mobility impairments, or involvement of trigger points in the suboccipital, upper trapezius, sternocleidomastoid, or cervical paraspinal muscles, as well as psychosocial factors such as stress, pain-related anxiety, or maladaptive coping [Bialosky et al., 2009], although empirical evidence supporting specific matching strategies remains limited. Future trials should therefore prioritize mechanism-informed, personalized approaches and consider stratifying participants according to these clinical profiles to enhance treatment effectiveness and ecological validity. From a safety perspective, manual therapy was generally reported as well tolerated, with only mild and transient adverse events reported, although incomplete reporting, particularly for high-velocity techniques, warrants cautious interpretation [Turner et al., 2018].

4.1. Limitations

This review presents several limitations that should be acknowledged. First, in line with the methodology of a scoping review, we did not perform a formal risk-of-bias assessment of the included RCTs. While this approach allowed us to map the available literature, it limits the interpretation of the quality and reliability of the evidence.

Secondly, the included studies showed high heterogeneity in terms of manual therapy techniques, targeted anatomical structures, treatment frequency and duration, and therapist qualifications. This variability makes it difficult to compare interventions and draw specific conclusions about what works best and for whom. Additionally, most studies did not provide a clear theoretical rationale or mechanistic explanation for the intervention, and none included objective physiological outcome measures (imaging, stiffness markers), limiting our understanding of

how manual therapy exerts its effects.

The interventions were rarely tailored to the individual clinical presentation of participants. Standardized protocols were commonly used, without accounting for patient-specific factors such as symptom severity, muscle dysfunction, or psychosocial variables. This limits the validity of the interventions and highlights the need for more personalized, mechanism-informed approaches in future research.

Moreover, the search was restricted to articles published in English and Spanish, which may have resulted in the omission of relevant studies available in other languages. This language restriction may introduce selection bias and limit the comprehensiveness and representativeness of the evidence mapped. Future reviews would benefit from including a broader range of languages to ensure more complete retrieval of global research output. Additionally, although the search strategy incorporated broad manual therapy terms, the inclusion of specific mechanistic keywords related to myofascial pain and trigger points may have slightly influenced retrieval toward studies with a myofascial focus, potentially underrepresenting trials centered on joint-based or non–myofascial manual therapy approaches.

Finally, while restricting the inclusion to randomized controlled trials strengthens the internal validity of the mapped evidence, it excludes valuable information from other study designs, such as cohort studies, case series, or pragmatic trials. These studies may provide more detailed descriptions of individualized intervention protocols, long-term outcomes, or real-world clinical applications. Consequently, the characterization of "clinical characteristics" presented in this review is limited primarily to the experimental context of RCTs, and future research including broader study designs could offer a more comprehensive understanding of manual therapy interventions for TTH, aimed at developing standardized-personalized, and evidence-based protocols. Future studies should investigate the dose-response relationship, incorporate long-term follow-up, include objective physiological markers.

4.2. Clinical implications

This review highlights that manual therapy may benefit individuals with TTH. However, it also underscores the need for improved reporting and mechanism-informed approaches, as these aspects were largely absent from the included studies, which may limit their standardized transferability to clinical practice. Furthermore, there is a need to develop evidence-informed, individualized treatment protocols that move beyond the rigid standardization typically required in clinical trial settings, in order to better reflect the complexity of real-world clinical practice.

5. Conclusion

This scoping review mapped the characteristics of manual therapy interventions used in RCTs for individuals with tension-type headache and highlighted substantial heterogeneity in techniques, targeted anatomical structures, treatment dosage, therapist expertise, and outcome measures.

Our review identified several key gaps in the literature: the lack of mechanistic rationale underpinning interventions, limited individualization of therapy to patient-specific factors, inconsistent outcome measures, and scarce long-term follow-up. To address these gaps, future research should adopt mechanism-informed and patient-centered approaches, guided by frameworks such as the bio-psychosocial model or stratified care.

CRediT authorship contribution statement

Ana Bravo-Vazquez: Investigation, Conceptualization. **Ernesto Anarte-Lazo:** Formal analysis, Data curation, Conceptualization. **M. Elena Gonzalez-Alvarez:** Formal analysis, Data curation. **Cleofas Rodriguez-Blanco:** Methodology, Conceptualization. **Carlos Bernal-Utrera:** Methodology, Conceptualization.

Data availability statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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