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Effectiveness of Manipulative Therapy on Neck Pain, Function and Disability. A Systematic Review

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ABSTRACT

Background: Neck pain is a common musculoskeletal issue affecting people worldwide, and manipulative therapy is implemented as a treatment for it.

Aim: To analyse the effects of different manipulative therapy techniques on pain intensity, sensitivity and function in patients with neck pain.

Methods. Studies between 2012 and April 2022 were selected to investigate the effectiveness of manipulative therapy on neck pain, function and disability. The databases PubMed ®, CNKI, Science Direct, Springer LINK, ResearchGate, Semantic Scholar, Taylor & Francis Online and Google Scholar were utilised. The selection criteria included studies involving human subjects with neck musculoskeletal pain, focusing on the effects of manipulative therapy on neck pain management and function.

Results: 10 studies with 573 subjects were included. Strong evidence supported that manipulative therapy was effective in reducing pain and increasing the pain threshold and the function of the neck. A significant ($p<0.05$) positive effect was reported by 100% of studies that implemented the above parameters. Moderate evidence showed that manipulative therapy was effective in the management of the disability of the neck. The ratio of positive effect was 66.66% among involved studies with very significant results ($p<0.01$). Moderate evidence with a limited amount of study showed a significant increase in muscle strength after manipulative therapy ($p<0.05$).

*Conclusions***.** Manipulative therapy is effective in reducing neck pain intensity and sensitivity as well as improving neck function and reducing disability. The combined application of manipulative therapy is always more effective than the isolated application of manipulative therapy on patients with neck pain.

Keywords: neck pain; manipulative therapy; effectiveness; pain threshold; pain intensity; neck function

INTRODUCTION

Pain is a complicated feeling that results from a mix of physical, mental, and social factors. Neck pain is one of the most frequent musculoskeletal pains nowadays in populations all over the world. According to the Global Burden of Disease 2010 study, neck pain is the 4th cause of disability which ranked globally (Shin et al., 2022). Since neck pain tends to be a chronic problem, identifying the risk

factors are very important in the prevention, early-stage diagnosis, treatment, and management of neck pain (Kazeminasab et al., 2022; Kim et al., 2018). According to a systematic review conducted by Kim and colleagues, the most significant risk factors are increased muscular tension, low mood, role conflicts, and demanding job responsibilities (Kim et al., 2018). The prevalence of neck pain in females is higher than in males in every age stage (Safiri et al., 2017, Shin et al., 2019). There are different systems of categorising neck pain including: Duration, Severity, Centralisation, Pathoanatomical, Mechanical (non-specific), and Treatment-Based. Non-specific neck pain is defined as pain or discomfort around the neck and/or shoulder region with/without pain referred to the upper extremities (Fejer et al., 2006).

Treatment of neck pain includes manipulative therapy which is implemented widely all over the world. The Ontario Protocol for Traffic Injury Management (OPTIMa) Collaboration suggests that for mild to moderate neck pain lasting three months or less, healthcare professionals can contemplate offering structured patient education along with a choice of treatments such as a combination of range of motion exercises with manipulation or mobilisation (Lin et al., 2020)thoracic and cervical. Furthermore, The American Physical Therapy Association (APTA) suggests that the approach to treating neck pain should involve education, mobilisation or manipulation of the cervical and thoracic areas, exercises, and the potential use of traction (Childs et al., 2008). Moreover, in a randomised trial carried out by Bronfort and colleagues, the results show that individuals who underwent 12 weeks of spinal manipulation therapy experienced more significant relief from neck pain compared to those who received medication (Bronfort et al., 2012). Additionally, various manipulation and mobilisation techniques have shown an association with relieving chronic neck pain and improving cervical spine function (Coulter et al., 2019) and manual therapy has been found to be more effective than interventions like electrotherapy, hyperthermia, and infrared radiation therapy for certain patients with cervical spondylosis and neck pain (Huisman et al., 2013**).**

Many studies have been done to analyse different manipulative therapy techniques and their effects on different catalogues of neck pain, but there has been a lack of work that reviews existing researches and compares the effectiveness of different therapy techniques. Therefore, the purpose of this systematic review is to analyse the existing manipulative techniques and their effectiveness on various aspects of neck pain.

METHODS

This systematic review analyses 10 published research. The selection of articles is based on the PRISMA-guidelines (Preferred Reporting Items for Systematic Reviews and Meta-Analysis). The PRISMA flow diagram (Haddaway et al., 2022), which included searches of database for this research is presented in Figure 1.

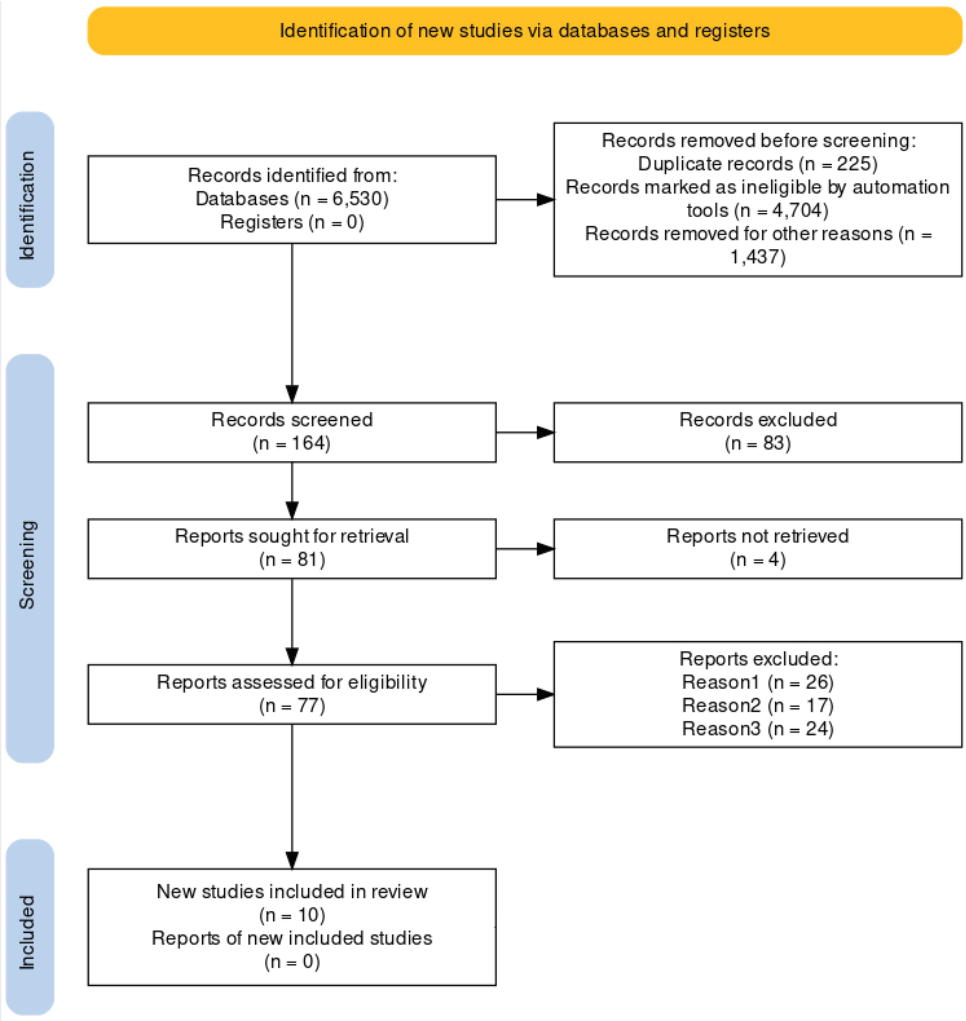

Figure 1. **PRISMA flow diagram included searches of database**

Search Strategy and Eligibility Criteria. PubMed ®, CNKI, Science Direct, Springer LINK, ResearchGate, Semantic Scholar, Taylor & Francis Online and Google Scholar were searched until April 2023. The Keywords include the question and the relevant terms if available. The search strategy was based on the following combination of terms:

'manipulative therapy'/exp OR manipulative medicine/exp OR physiotherapy/exp OR kinesiotherapy/exp OR physiotherapist/de OR(((manipulate* OR manual OR physical OR physio) NEAR/3 (medicine* OR therap * OR treat * OR musculoskelet*)) OR((joint* OR cervical OR neck OR musculoskelet* OR skelet OR muscul* OR muscle* OR arm * OR spinal* OR spine* OR vertebra* OR yofascial) NEAR/3 (manual* OR manipulate*))) AND ((joint* OR cervical/exp OR neck/exp OR musculoskelet/exp OR skelet OR muscul* OR muscle* OR arm * OR spinal* OR spine* OR vertebra* OR yofascial) NEAR/3 (pain/exp OR syndrome* OR disorder* OR dysfunction* OR blockage)) AND ('pain parameter'/exp OR (((pain/exp OR nocicept*) NEAR/3 (modulat* OR threshold* OR control* OR inhibit* OR facilitate* OR toleran*)) AND (('function'/exp OR strength/exp OR movement* OR quality* OR symptom* OR pain*) NEAR/3 (effect/exp OR change/exp OR effective* OR effectiveness* OR increase* OR decrease* OR facilate)) AND ('clinical study'/exp OR (clinical OR patient* OR trail)) NOT ([animals]/lim NOT [humans]/lim)

Reference lists were hand-searched and relevant articles were included to make the search as complete as possible.

Eligibility criteria were framed by the PICO (Patient-Intervention-Comparison-Outcome) methodology. To be included in the present systematic review, the articles had to present the results of comparison clinical studies I on symptom management effects (O) of manipulative therapy intervention (I) in patients with neck pain (P).

Study Selection. Inclusion criteria were 1. The research involves humans with musculoskeletal pain in the neck area; 2. The aims of the research need to relate to the effect of manipulative therapy on the pain management or function of the neck; 3. The language used in reports needs to be English or Chinese; 4. The full paper of the original research is available and published. The research needs to meet the entire requirement, otherwise, they would be excluded. Manipulative therapy techniques include any acupressure and muscle energy technique used to release the soft tissue or peripheral structure with the aim of analgesia and function improvement.

To achieve a more reliable result, the included articles would be filtered by the following excluded criteria: 1. The measurement and result were not reported in detailed mathematic expression; 2. The statistics method, measurement or proce-

dure of the experiment was not standardised/with higher bias/not fully described in the article; 3. The group separation methodology did not meet the scientific requirement.

Level of Evidence. The studies were processed with the Controlled Trials checklist of the Scottish Intercollegiate Guidelines Network (SIGN). The overall quality of the evidence was graded on a 4 point-scale (high, moderate, low, very low) according to the Grades of Recommendation, Assessment, and Development and Evaluation (GRADE) approach.

Data Items and Collection. Information was extracted from the included studies and listed in the evidence tables. The information includes the study design; sample size; characteristics of study participants; outcome measurement methods; intervention methods; main results; discussion and methodological quality.

Outcome Measures. The principal outcome measure was changes in function or pain intensity sensitivity or perception. In the included studies, these measures were taken with goniometry, pressure algometry and related scales.

RESULTS

A total of 6530 studies were identified, after the removal of duplicates and screening, 10 studies were included in this systematic review.

Risk of Bias and Level of Evidence. Among the included studies, 9 out of 10 study designs were single-blinded Randomised controlled trials (RCT=9), and one study design was controlled before and after the study (CBA=1) (Cagnie et al, 2013). The evidence grades of the included studies ranged between high to moderate (High=7, Moderate=10), the recommendation level of the included studies was all strong (Strong=10), which means the authors of all studies were confident that the true effect is similar to the estimated effect and the positive or negative results were clearly reported.

The qualities of the studies were all acceptable according to the SIGN approach. The risk of bias and the level of evidence of the different studies are reported in Table 1. The methodological quality of the included studies was acceptable (+, N=10), which are acceptable. All studies showed a low risk of bias, which means all the studies are without limitations and have confidence in results not affected.

Table 1. **Methodological Quality of the Included Studies**

Author	1	2	3	4	5	6	7	8	9	10	Total
Lendraitienė et al (2017)	+	+	+	+/-	+	+	+	+	NA	NA	+
Lari et al (2016)	+	+	+	+/-	+	+	+	+	NA	NA	+
Parab et al (2020)	+	+	+	+/-	+	+	+	+	NA	NA	+
Chao et al (2016)	+	+	+	+/-	+	+	+	+	NA	NA	+
Cagnie et al (2013)	+	+/-	+/-	+/-	+/-	+	+	+	NA	NA	+
Campelo et al (2013)	+	+	+	+/-	+	+	+	+	NA	NA	+
Kim et al (2015)	+	+	+	+/-	+	+	+	+	NA	NA	+
Osama (2021)	+	+	+	+/-	+	+	+	+/-	NA	NA	+
Siddiqui et al (2022)	+	+	+	+/-	+	+	+	+	NA	NA	+
Saleem et al (2023)	+	+	+	+/-	+	+	+	+	NA	NA	+

Note: 1 = a clearly focused and appropriate question is addressed, 2= assignment of subjects to treatment groups is randomised, 3 = an adequate concealment method is used, 4 = subject and investigators are kept blind about treatment allocation, 5 = treatment and control groups are similar at the start of the trial, 6 = groups differ only on the treatment under investigation, 7 = outcomes are measured in a standard, valid and reliable way, 8 = percentages of drop-outs are reported, 9 = subjects are analysed in groups to which they were allocated, 10 = results are comparable for all sites at which the study is carried out. + = YES, - = No, NA = not applicable.

Characteristics of the Participants. The characteristics of the participants of each study were extracted, including sample size, gender, age, main complaint, and the baseline difference between groups. There were 573 subjects participating in the studies. There were 57.3 participants in each study on average. However, gender information was missing in two studies. 8 of them reported the gender arrange with 329 (66.45) female and 166 (33.54%) male. The average age of the included studies was 28 years, the oldest participant was over 60, and the youngest participant was over 18. There was no significant difference between the groups of the included studies from the statistical view. Detailed information on the participants of each study is in *Table 2.*

Table 2. **Characteristics of Participants and Statistic Results**

Author	Sample Size and Group Sets	Gender	Age (years)	Main Complain
Lendraitienė et al (2017)	IC: n=15 KT: n=12	IC: 11F, 4M Group II: 8F, 4M	IC: 26 ± 6.89 KT: 23.83 ± 3.66	Neck pain with latent myofascia trigger point (LMTP) in upper trapezius; without any other health problems
Lari et al (2016)	DN&MET: n=20 MET: n=20 DN: n=20	Females	DN&MET: 25.60±0.80 MET: 24.78±0.72 DN: 24.60±0.93	Neck pain with LMTP in upper trapezius
Parab et al (2020)	MFR: n=27 CS: n=27	NA	MFR: 25.92±6.34 CS: 24.14 ± 4.33	Out-patient; diagnosed MTP in trapezius; no acute injured condition or other disease
Chao et al (2016)	MPR: n=15 MPR&MKT: n=16	MPR: 12F, 3M MPR&MKT: 12F, 4M	Group I: 30±6.5 Group II: 28 ±4.6	Out-patient; MTP in the upper trapezius, symptom lasted for several months (Group I: 11.2±8.6; Group II: 11.4±7.2)
Cagnie et al (2013)	n=19 IC group	16F, 3M	39.5±8.32	Office workers; duration of employment 13.1±7.7 yrs; Duration of work hours per week: 39.1±5.1; mild neck and shoulder pain

Author	Sample Size and Group Sets	Gender	Age (years)	Main Complain
Campelo et al (2013)	WS: n=25 PI: n=22 IC: n=24 PS: n=23 MET: n=23	WS: 18F, 7M PI: 14F, 8M IC: 20F, 4M PS: 17F, 6M MET: 16F, 7M	WS: 20.44 ± 2.08 PG: 20.23 ± 1.57 IC: 20.08 ± 1.21 PS: 20.6 ± 1.93 MET: 20.35 ± 2.14	LMTP on upper trapezius due to computer work, LMTP mostly happen on the dominant side; no pharmaco-logical therapy or physio-therapy during the treatment; no diagnosed health problem; no history of head and upper trunk surgery or trauma
Kim et al (2015)	ART: n=8 JM: n=8 Control: n=8	NA	ART: 40.0±10.4 JM: 39.3±14.9 CG: 47.0±10.0	Out-patient with chronic neck pain over 3 months and mild disability based on NDI (5-14 points)
Osama (2021)	n=78 SS group AI-MET RI-MET	SS: 20F, 6M; the other groups: 16F, 10M for each of them	SS: 43.09±8.55 AI-MET: 40.31±13.17 RI-MET: 41.48±13.37	sub-acute or chronic neck pain for over 4 weeks, numeric pain rating scale (NPRS) rang-ing from 4-8, and has pain or limitation during neck movement

Author	Sample Size and Group Sets	Gender	Age (years)	Main Complain
Siddiqui et al (2022)	AI-MET: n=40; RI-MET: n=40	AI-MET: 29F, 11M RI-MET: 28F, 11M	AI-MET: 33.82±9.31 RI-MET: 33.30 ± 8.76	moderate neck pain (3.5-7.4 cm on VAS) for over 4 weeks (sub-acute and chronic stage) and with limitation of neck ROM. No history of trauma, fracture surgical procedure or other diagnosed disease of the cervical spine. No suffering of any neurological condition.
Saleem et al (2023)	n=36 IC group SC group	16F, 20M	32.96±5.91	Out-patients with neck pain over 3 months, minimum 5 trigger points on the upper trapezius bilaterally, NPRS score of 3-7
Total		n=573		

Note: CG=control group, EG=experimental group, MET=muscle energy technique; AI=Autogenic Inhibition, RI=reciprocal inhibition, PG=placebo group, M=male, F=female, n=number of participants, PPT=pressure pain threshold, LMTP=latent myofascial trigger point, ART=active release technique, IC=Ischemic Compression, JM=joint mobilisation, MFR=myofascial release, MKT=myofascial kinesio-taping, NDI=neck disability index, NPRS=numeric pain rating scale, MTP=myofascial trigger point, ROM=range of motion, PS=passive stretching, KT=kinesio-taping, SS=static stretching, VAS=visual analoguescale, DN=dry needling, CS=cryo-stretching, WS=wait-and-see group, SC=strain counterstrain technique, MPR= manual pressure release, NA=not applicable

Characteristics of Group Setting and Intervention. Among the RCT studies, there were 2 studies set the control group, 1 study set a placebo group. In the other eight studies, a comparison was made between two or three groups of which at least one group received one or two manipulative therapy interventions and the other

groups received a different manipulative therapy or physical therapy. There were 9 study designs that were single-blind.

In the included studies, the intervention sessions ranged from one time up to 12 times. 5 studies assessed the acute effect of the intervention with 1 session, 2 of which followed up for one week for repeated measures. 2 studies repeated the session two to three times in one week to assess the short-term effect of the intervention and 3 studies continued the therapy for 4 weeks.

All the included studies assessed the effectiveness of at least one manipulative therapy technique on soft tissue, three studies involved physical therapy as a comparison including kinesio-taping (n=2) and dry needling (n=1). 5 studies applied 4 kinds of muscle energy techniques including AI-MET (n=2), RI-MET (n=2), PIR (2) and CS (n=1); 6 studies applied 2 kinds of compressive techniques including ischemic compression technique (IC) (n=4) and myofascial release technique (MFR) (n=2). Other manipulative therapy techniques were involved in some studies, including active release technique (ART) (n=1), joint mobilisation (JM) (n=1), static stretching (SS) (n=1) and strain counter-strain technique (SC) (n=2). The details of the intervention method and outcome measures are presented in Table 3.

Table 3. **Interventions and Outcome Measures**

Author	Intervention	Outcome Measures
Lendraitienė et al (2017)	Ischemic compression (IC), kinesio-taping (KP)	Pain intensity, pain sensitivity, mobility
Lari et al (2016)	Muscle energy technique (MET), dry needling (DN) and a combination of two techniques (MET&DN)	Pain intensity, pain sensitivity active mobility in lateroflexion
Parab et al (2020)	Myofascial release with deep transverse friction and cross-hand technique (MFR); cryo-stretching with static stretch an isometric contraction (CS)	Pain intensity, pain sensitivity, mobility
Chao et al (2016)	Manual pressure release (MPR), a combination of MPR with kinesio-taping (MPR&MKT)	PPT, muscle stiffness, local muscle mechanical activity
Cagnie et al (2013)	Ischemic compression	Pain intensity, mobility, muscle strength, neck disability, pain sensitivity
Campelo et al (2013)	Ischemic compression, passive stretching, muscle energy technique	Mobility, pressure pain sensitivity

Kim et al (2015)	Active release technique (ART), joint mobilisation (JM)	Intensity of pain, pain sensitivity, passive mobility
Osama (2021)	Static stretching (SS), AI-MET, RI-MET	Pain intensity, isometric muscle strength
Siddiqui et al (2022)	AI-MET and RI-MET with conventional physiotherapy treatment	Pain intensity, mobility, functional disability
Saleem et al (2023)	Ischemic compression technique, strain counter strain technique	Pain intensity, neck disability, mobility in lateral flexion

Note: MET=muscle energy technique; AI=Autogenic Inhibition, RI=reciprocal inhibition, PPT=pressure pain threshold, ART=active release technique, IC=Ischemic Compression, JM=joint mobilisation, MFR=myofascial release, MKT=myofascial kinesio-taping, KT=kinesio-taping, SS=static stretching, DN=dry needling, CS=cryo-stretching, SC=strain counters train technique, MPR= manual pressure release

Characteristics of the Results. The current evidence showed a strong analgesic effect of manipulative therapy on pain intensity and sensitivity in patients with myofascial disorder in neck pain. The evidence of the effects of manipulative therapy on neck function was moderate.

All 9 studies that measured pain intensity reported a significant decrease of VAS, NPRS, or PPP after intervention with significant ($p<0.05$) (n=4) or very significant ($p<0.001$) (n=5) results, the ratio of a significant effective result of manipulative therapy on decreasing pain intensity among the included studies was 100%. Of all these studies, 6 studies had high GRADES while 3 studies had moderate grades, all of which had acceptable methodological quality (+) and strong recommendation levels.

For the effects on pain sensitivity, all 7 studies that measured pain sensitivity reported a significant increase of the PPT after intervention with significant ($p<0.05$) (n=3) or very significant ($p<0.001$) (n=4) results, the ratio of the significant effective result of manipulative therapy on decreasing pain sensitivity among the included studies was 100%. The mean value of PPT was very different ranging from 3-20 after therapy in different studies. Of all these studies, 4 studies had high GRADES while 3 studies had moderate grades, all of which had acceptable methodological quality (+) and strong recommendation levels.

For neck function, all 8 studies that measured the mobility of the neck reported a significant increase of the ROM after intervention with significant ($p<0.05$) (n=3) or very significant ($p<0.001$) (n=5) results, the ratio of the significant effective result of manipulative therapy on improving the neck mobility among the included studies was 100%.

The value of ROM in the tested direction after intervention in each study was significantly increased but still did not reach the normal value. Of all these studies,

5 studies had high-grade evidence, while 3 studies had moderate-grade evidence, all of which had acceptable methodological quality (+) and strong recommendation levels.

For the disability of neck function, 2 studies out of 3 (66.66%) that measured the parameter reported a decrease in the NDI with a very significant result ($p<0.001$), the ratio of the significant effective result of manipulative therapy on improving the neck disability among the included studies was 66.66%.

All 3 studies that measured muscle strength reported a significant increase after intervention ($p<0.05$) (Cagnie et al., 2013; Chao et al., 2016; Osama, 2021). Chao et al. (2016) also reported a significant increase in the MMG ($p<0.05$) after the intervention, the ratio of the significant effective result of manipulative therapy on improving muscle strength among the included studies was 100%. The detailed statistical results and conclusion of each study are presented in Table 4.

Table 4. **Statistical Results and Conclusions**

Author	**Pre-therapy Intergroup Groups Difference and Statistic Results**	**Conclusion**
Lendraitienė et al (2017)	Pre: intergroup $p>0.05$ Post: intragroup and intergroup $p<0.05$(PPT, VAS, ROM)	Ischemic compression is more effective than kinesio taping in pain management of LMTP
Lari et al (2016)	Pre: intergroup $p>0.05$ Post: intragroup $p<0.05$ (VAS, PPT, ROM); intergroup $p<0.05$ (VAS)	MET and DN are effective for treating MTP. The combination of the two methods has a better effect.
Parab et al (2020)	Pre: intergroup $p>0.05$ Post: intragroup $p<0.05$ (VAS, PPT, ROM); intergroup $p<0.05$ (ROM)	MFR and cryo-stretching were effective in the management of upper trapezius TP
Chao et al (2016)	Pre: intergroup $p>0.05$ Post: intragroup $p<0.05$ (VAS, stiffness, MMG); intergroup $p<0.05$ (stiffness, MMG)	MPR and MPR+taping therapy are effective for reducing pain in patients with MTP in upper trapezius MTP. MPR +Taping can affect muscle stiffness and muscle contraction patterns better, which are helpful for the relaxation of MTP.

Author	Pre-therapy Intergroup Groups Difference and Statistic Results	Conclusion
Cagnie et al (2013)	Pre: intergroup $p>0.05$ Post: intragroup (IC) $p<0.05$ (NPRS, PPT, mobility, strength)	The 4 weeks of IC treatment of MTPs could improve the neck/shoulder complaints, PPT, mobility and muscle strength and the influence could last to the 6-month follow-up
Campelo et al (2013)	Pre: intergroup $p>0.05$ Post: acute intragroup $p<0.05$ (ROM, PPT, VAS) after 24h~1 week: intragroup (IC) $p<0.05$ (ROM, PPT, VAS)	IC, PS and MET were effective in the treatment of the LMPT including improving the ROM of the cervical spine and decreasing the pressure pain sensitivity. The IC therapy had a longer effect until 1 week after therapy compared to other therapies.
Kim et al (2015)	Pre: intergroup $p>0.05$ Post: intragroup (ART, JM) $p<0.05$ (VAS, PPT); intragroup (ART) $p<0.05$ (ROM); intergroup $p<0.05$ (VAS)	Both ART and JM were effective in the treatment of neck pain in ROM, PPT and VAS. The ART was more effective than JM.
Osama (2021)	Pre: intergroup $p>0.05$ Post: first session: intragroup $p<0.05$ (NPRS, MSD); intergroup $p<0.05$ (MSD) Fifth session: intragroup $p<0.05$ (NPRS, MSD); intergroup $p<0.05$ (MSD)	Both AI-MET and RI-MET were effective in improving isometric muscle strength in patients with mechanical neck pain, AI-MET was more effective than RI-MET and SS.
Siddiqui et al (2022)	Pre: intergroup $p>0.05$ Post: first session: intragroup $p<0.05$ (VAS); intergroup $p<0.05$ (VAS) 12^{th} session: intragroup $p<0.05$ (VAS); intergroup $p<0.05$ (VAS, NDI, ROM)	Both AT-MET and RI-MET were effective in improving pain, ROM, functional disability for neck pain, the AI-MET was more effective than RI-MET.

Author	Pre-therapy Intergroup Groups Difference and Statistic Results	Conclusion
Saleem et al (2023)	Pre: intergroup $p>0.05$ Post: intragroup $p<0.05$ (NPRS, NDI, ROM); intergroup $p>0.05$	The 4 weeks intervention of the ischemic compression and counter strain are effective in reducing the intensity of pain, reducing neck disability and improving the ROM. These two techniques have the same effects without significant differences.

Note: MET=muscle energy technique; PPT=pressure pain threshold, LMTP=latent myofascial trigger point, ART=active release technique, IC=Ischemic Compression, JM=joint mobilisation, MFR=myofascial release, NDI=neck disability index, NPRS=numeric pain rating scale, MTP=myofascial trigger point, ROM=range of motion, PS=passive stretching, SS=static stretching, VAS=visual analoguescale, DN=dry needling, MPR=manual pressure release, TP=trigger point, MMG=mechanomyography, MSD=modified sphygmomanometer dynamometry, p=p value

DISCUSSION

The manipulative therapy interventions that reported most effective on pain intensity, pain sensitivity, and ROM are ischemic compression (n=4) (Lendraitienė et al., 2017; Campelo et al., 2013; Cagnie et al., 2013; Saleem et al., 2023) and MET techniques (Lari et al., 2016; Campelo et al., 2013, Osama, 2021; Siddiqui et al., 2022, Parab et al., 2020, Saleem et al., 2023, Kim et al., 2015). The pain intensity changes were obviously different from the pre-intervention condition at the treated locations. The average value of pain intensity decreased to 4 or lower (mild pain), which means the manipulative therapy could achieve the goal of pain release. The value of the PPT in each study was various maybe because of the different calculations method of PPT, equipment, procedure and researchers. However, for the ROM in a specific direction, one study reported a non-significant acute effect in extension and lateroflexion ROM of the neck (Lendraitienė et al., 2017).

For reducing the disability of the neck, the MET techniques were effective (Siddiqui et al., 2022, Saleem et al., 2023). The study that resulted in non-significant results in NDI applied ischemic compression (Cagnie et al., 2013). To compare these three results to each other, the non-significant result in NDI might be a result of the isolated ischemic therapy, or it could be due to the study design. The controlled before-after study design might affect the pre-test result before the intervention and result in a bias of the statistics results. On the other hand, the iso-

lated ischemic compression intervention might not be as effective as other MET or combined manipulative therapies in improving the function of the neck.

The MET techniques (Chao et al., 2016, Osama, 2021) and ischemic compression (Cagnie et al., 2013) were also effective on muscle strength. However, Osama (2021) reported that because of a lack of financial support, the measurement of isometric muscle strength in the study was modified sphygmomanometer dynamometry (MSD). For a better result, Osama (2021) recommends using a gold-standard isokinetic dynamometer and electromyography in future studies.

It was reported that the effect of IC (Lendraitienė et al., 2017; Campelo et al., 2013), PIR+DN (Lari et al., 2016), MFR+MKT (Chao et al., 2016), ART (Kim et al., 2015), AI-MET (Osama, 2021; Siddiqui et al., 2022) were better than the other intervention techniques in the studies. One study reported a non-significant difference between IC and SC interventions (Saleem et al., 2023).

The results of most studies showed a positive effect on the pain management of neck pain and agreed with other studies with strong evidence. The neck function increased after intervention in ROM and muscle strength with strong evidence. The evidence of the improvement in the disability of the neck was moderate. However, maybe it was because the studies that involved the NDI in this systematic study were too small (n=3). Therefore, to get a better conclusion and evaluate the quality of evidence, more studies that involved NDI as an outcome measure should be included. One study mentioned that the limitation in the research was the short duration of therapy, and all female subjects (Lari et al., 2016). The evidence was rated as high-quality evidence and acceptable methodology quality and strong recommendation. Another study summarised that MSD was used for the measurement of isometric muscle strength because of a lack of financial support, recommended using gold standard isokinetic dynamometer and electromyography in further studies (Osama, 2021). The evidence was rated as high-quality, with acceptable methodology quality and supporting strong recommendation. Most of the included studies were multiple intervention groups without a blank, placebo, or control group, which might decrease the quality of the evidence. However, this condition is not rare in physiotherapy trials. On the aspect of this problem, one study explained that the subjects involved in the research were patients who required therapy. Therefore, there was only the comparative group instead of the control group. However, the confounding factors and biases were kept according to guidelines (Siddiqui et al., 2022). In this case, the bias of the evidence would get corrected and improve the quality of the evidence during the evaluation of this systematic review study.

The included studies of this systematic review implemented local manual pressure, several MET techniques, kinesio-taping, dry needling, two myofascial

techniques, joint mobilisation and two stretching techniques as interventions for neck pain, function and disability. For most studies, the techniques were very focused on MET techniques and manual pressure therapy which, therefore, provided strong evidence of their acute effectiveness during and after the intervention. However, the longest study was designed for 12 sessions and most studies only tested the short-term effect that maximal up to one week. The long-term effects of the involved techniques still need stronger clinical evidence to support them (Cohen, 2015).

Besides, the presence of patient heterogeneity with varying neck pain durations, and pain severity levels introduces specific limitations. These limitations can complicate the generalisation of findings or the assessment of intervention effectiveness. However, these inherent limitations also offer strengths in terms of clinical relevance, the potential for tailored interventions, and practical insights into managing neck pain, making the results more applicable to a broader range of patients in clinical practice.

As the mechanism of manipulative therapy on neck pain is being revealed (Emerich et al. 2014; Bialosky et al., 2009), therapists can select more targetable techniques according to the specific condition of patients. Since the modifying mechanism relies on the effects of manipulative therapy on multiple systems including the anatomical structure, soft tissue and CNS (Voogt et al., 2014; de Camargo et al., 2011; Sherman et al., 2004), various techniques based on different medicine theory, such as traditional Chinese theory, can get involved and combined with the current effective techniques to modulate it from hierarchical level (Kligler et al., 2018; Liu et al., 2015).

CONCLUSIONS

Manipulative therapy is effective in reducing pain intensity and sensitivity in patients with neck pain. Manipulative therapy is effective in improving the neck function of patients with neck pain. The combined application of manipulative therapy is always more effective than the isolated application of manipulative therapy on patients with neck pain.

For further clinical application, manipulative therapy, including ischemic compression, post-isometric relaxation combined with dry needling, autogenic inhibition muscle energy technique, reciprocal inhibition muscle energy technique, myofascial Release combined with kinesio-taping and active release technique are recommended in pain management and improvement of function for patients with neck pain. The combined application of therapy is strongly recommended over isolated application. The optimal combination of manipulative therapy still needs

further RCT research. However, to reduce the prevalence of neck pain, a good lifestyle and prevention of the risk factors are crucial steps.

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Manipuliacinės terapijos poveikis kaklo skausmui, funkcijai ir negaliai. Sisteminė apžvalga

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SANTRAUKA

Tyrimo pagrindimas. Manipuliacinė terapija yra dažna raumenų ir kaulų sistemos problema, su kuria susiduria žmonės visame pasaulyje.

Tikslas – išanalizuoti skirtingų manipuliacinės terapijos metodų poveikį skausmo intensyvumui, jautrumui ir funkcijoms pacientams, kenčiantiems nuo kaklo skausmo.

Metodai. Analizuojami nuo 2012 m. iki 2022 m. balandžio mėn. atlikti tyrimai, kuriuose tiriamas manipuliacinės terapijos veiksmingumas kaklo skausmui, funkcijai ir negaliai. Naudotasi duomenų bazėmis „PubMed“, „CNKI“, „Science Direct“, „Springer LINK“, „Research Gate“, „Semantic Scholar“, „Taylor & Francis Online“ ir „Google Scholar“. Atrankos kriterijai: tyrimai, kuriuose dalyvavo žmonės, kenčiantys kaklo raumenų ir skeleto skausmą, daugiausia dėmesio skiriant manipuliacinės terapijos poveikiui kaklo skausmo valdymui ir funkcijai.

Rezultatai. Įtraukta 10 tyrimų, kuriuose dalyvavo 573 asmenys. Remiantis tyrimo duomenimis, manipuliacinė terapija buvo veiksminga mažinant skausmą ir didinant skausmo slenkstį bei kaklo funkciją. Statistiškai reikšmingas ($p < 0,05$) teigiamas poveikis nustatytas 100 proc. tyrimų, kuriuose buvo pasirinkti minėti parametrai. Manipuliacinė terapija buvo veiksminga gydant kaklo negalią. Teigiamo poveikio santykis tarp tyrimų, kurių rezultatai buvo statistiškai reikšmingi – 66,66 proc. ($p < 0,01$). Be to, remiantis kai kurių tyrimų duomenimis, po manipuliacinės terapijos reikšmingai padidėjo raumenų jėga ($p < 0,05$).

Išvados. Manipuliacinė terapija yra veiksminga mažinant kaklo skausmo intensyvumą ir jautrumą, taip pat gerinant kaklo funkciją ir mažinant neįgalumą. Kompleksinės manipuliacinės terapijos taikymas pacientams, kenčiantiems kaklo skausmą, visada yra veiksmingesnis nei pavienis manipuliacinės terapijos taikymas.

Raktažodžiai: kaklo skausmas, manipuliacinė terapija, veiksmingumas, skausmo slenkstis, skausmo intensyvumas, kaklo funkcija.

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