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REVIEW

Efficacy of Acupuncture in Treating Nape Back Myofascial Pain Syndrome: a Comprehensive Systematic Review and Meta-Analysis

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Introduction: Acupuncture, in particular, has received increasing attention in pain management in traditional medicine treatments. This study evaluated the effectiveness of acupuncture in treating nape back myofascial pain syndrome (MPS).

Methods: The literature on randomized controlled trials of acupuncture in the treatment of nape back MPS was retrieved by searching nine databases. Review Manager 5.4 software was used to merge and statistically analyze the extracted data, and Stata 18.0 was used to assess the risk of bias.

Results: Finally, 10 randomized controlled trials were included, with a total of 624 samples. The meta-analysis results indicated that acupuncture therapy could lower the NDI score [MD=−6.64, 95% CI (−10.95, −2.33), Z = 3.02, P = 0.003]. Acupuncture demonstrated superiority over the control group in addressing nape back myofascial pain condition, which reflected that the VAS score of the acupuncture treatment group was significantly lower than that of other treatment controls [SMD=−0.71, 95% CI (−1.07, −0.36), Z = 3.94, P < 0.0001]. Furthermore, in contrast to the control group, the improvement of PPT and right flexion CROM and rotation CROM in the acupuncture group was more evident (PPT: [MD = 0.95, 95% CI (0.63, 1.27), P < 0.001]) (right flexion CROM: [MD = 4.86, 95% CI (1.61, 8.12), P = 0.003]), (rotation CROM: [MD = 0.52, 95% CI (0.43,0.61), P < 0.00001]).

Conclusion: This study demonstrates that acupuncture is more effective in treating nape back MPS than the control group and provides strong evidence for the effectiveness of acupuncture in treating nape back MPS, filling a gap in the treatment of nape back MPS by Traditional Chinese Medicine.

Keywords: nape back myofascial pain syndrome, acupuncture therapy, system evaluation, meta-analysis

Introduction

Nape back MPS is a prevalent chronic pain condition. It is caused by a long-term chronic strain of myofascial, tendon, and related nerves in the upper trapezius, levator scapulae, and infraspinatus muscles. It is marked by active myofascial trigger points and pain upon palpation.[1] Nape back MPS is characterized by the presence of activated pain points, and finger pressure on the activated pain points usually causes pain and severe motor dysfunction. Factors contributing to the activation of pain points include overexertion, direct impact, visceral disease, and arthritis.[2] The primary manifestations of nape back MPS are chronic nonspecific cervical discomfort, etc. accompanied by dysfunction, stiffness, limited mobility, and weakness.[3] Epidemiological studies indicate the prevalence of cervical discomfort in the general populace is 5.9% to 38.7%, and 0.6% of people suffer from disabling neck pain every year. The prevalence of MPS among non-specific-neck-pain patients was 100%.[4]

The occurrence of nape back MPS is mostly due to long-term chronic strain, continuous strain, etc, leading to long-term excessive tension of myofascial tissue. This results in aseptic inflammation of the tendinous and muscle fibers, particularly in the upper trapezius and rhomboid muscles, causing inter-tissue edema, and gradual fibrosis.[5] Contemporary medical management of nape back MPS frequently employs oral non-steroidal anti-inflammatory medicines and other medications to mitigate inflammation and provide analgesia.[6] Studies have shown that oral non-steroidal anti-inflammatory drugs have large side effects and are likely to cause adverse reactions in cardiovascular, gastrointestinal, liver, kidney, brain, and lung.[7] It is still necessary to explore

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safer and more effective treatment options that can improve the prognosis of patients. Acupuncture has expanded a variety of treatment methods in form through continuous development in traditional medicine. However, it still follows the promotion and recovery of the patient's blood flow by piercing specific acupoints on the meridians. Acupuncture, a component of traditional Chinese medicine, has demonstrated substantial efficacy in pain management according to prior research.[8] Acupuncture for the treatment of nape back MPS has been shown to effectively relieve muscle tension proximally and improve cervical ROM in patients with nape back MPS.[9] Recent clinical trials of acupuncture for neck pain treatment have demonstrated considerable alleviation of pain and associated symptoms.[10]

Although the clinical evidence for the treatment of nape back MPS has become more and more abundant in recent years, the efficacy and safety of acupuncture therapy in treating nape back MPS remains uncertain. Although several studies have explored the efficacy of acupuncture in the treatment of item dorsal fasciitis syndrome, there is heterogeneity in the results, and the number of available studies is small, and most of them are small-sample trials, and most of them suffer from methodological problems (eg, inadequate randomization, blinding could not be fully implemented, and there is a lack of systematic quantitative analysis of the available evidence. By consulting the relevant literature, it was found that there was a significant lack of meta-analysis of the validity of acupuncture in the treatment of nape back MPS, and the clinical application also lacked systematic and standardized evidence-based medical research evidence. We conducted a meta-analysis and systematic evaluation to evaluate the usefulness of acupuncture on nape back MPS by using clearly defined outcome indicators, to fill this gap, aiming to offer systematic evidence-based medical evidence for acupuncture treatment of nape back MPS and offer significant insights for forthcoming treatment techniques.

Methods

The PROSPERO registration number of this study is CRD42024603536 and complies with the PRISMA declaration requirements.

Search Strategy

The retrieval method of subject words combined with free words was adopted to search databases PubMed, Embase, Scopus, etc. The retrieval period extended from the database's inception until October 18, 2024. The Chinese search terms include: nape back myofascial pain syndrome, shoulder back myofascial inflammation, nape back myofascial inflammation, fasciitis, myofascial pain syndrome, myofascial pain, back myofascial inflammation, acupuncture, acupuncture therapy; English search terms include: back of neck fasciitis, fasciitis, dorsiflexitis, cervical dorsal myofasciitis, dorsal shoulder fasciitis, myofascial trigger point pain, myofasciitis, myofascial pain, myofascial syndrome, acupuncture, acupuncture therapy, electroacupuncture, needling, randomized controlled trial, RCT. The retrieval strategy utilizes PubMed as a case study, with the exact retrieval method illustrated in Figure 1.

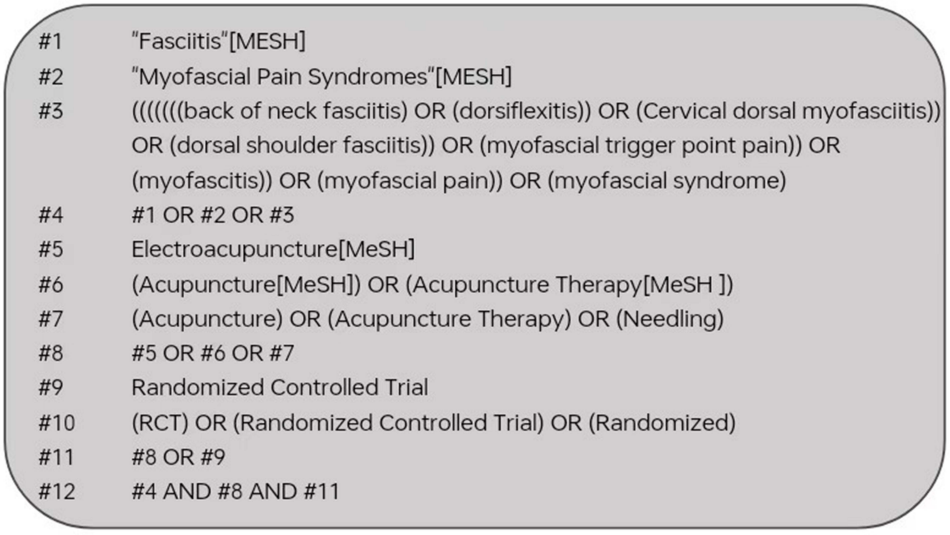

Figure 1 This figure shows the search strategy using Mesh subject terms in PubMed.

Inclusion Criteria

Research Type

Clinical randomized controlled trial (RCT) of acupuncture treatment of nape back MPS.

Research Object

In line with the Diagnosis and Therapeutic Effect of Diseases and Syndromes in Traditional Chinese Medicine.[11] Painology.[12] Chinese massage therapy.[13] Clinical Practice Guidelines-Physical Medicine and Rehabilitation.[14] Patients with the diagnostic criteria of nape back MPS in the literature. Participants were aged ≥18 years.

Intervention Measures

The experimental group was mainly treated with acupuncture or acupuncture combined with other therapies, including filiform needle, electroacupuncture, floating needle, warm acupuncture, electrothermal acupuncture, acupuncture combined with acupoint injection, etc, and the time, depth, or duration of acupuncture was not limited; the control group was treated with non-acupuncture therapy, which can be Chinese and Western medicine therapy or other treatment methods. Other treatment methods include: massage, non-steroidal anti-inflammatory drugs, lidocaine injection, low-frequency electrical stimulation, etc.

Outcome Measures

Including clinical effective rate, visual analog scale (VAS) score, neck disability index (NDI) score, cervical range of motion (CROM) score, pain rating index (PRI) score, present pain intensity (PPI) score, Northwick Park (NPQ) score, and one or more of the related indicators. The clinical efficacy was evaluated according to the TCM Syndrome Diagnostic Efficacy Standard.[11] The relevant standards (clinical cure: symptoms and signs disappeared, free movement, no recurrence within half a year; markedly effective: symptoms and signs disappeared, but the activity or weather changes slightly discomfort; effective: symptoms and signs improved, the back is still painful when the weather changes; ineffective: symptoms and signs did not change compared with before treatment).

Exclusion Criteria

The subjects had a history of trauma, or combined with other medical history such as heart disease, diabetes, etc.

Literature with obvious errors or missing data such as literature content data.

Non-journal papers such as master's and doctoral dissertations and conference papers.

Full text is not available.

Cohort studies, case reports, reviews of animal studies, etc.

Non-randomized controlled trials or multiple control groups.

Republished literature or repetitive literature.

Study Selection

The review team consisted of two graduate students in acupuncture with expertise in acupuncture, statistical methods, and myofascial disorders. Abstracts were first read for initial screening to determine if the study was eligible for an RCT and the intervention was acupuncture. For the remaining studies, the research team adopted the Cochrane risk bias evaluation tool RoB 2 (2019 Revised Edition)[15] to assess sources of risk of bias in RCTs. Two researchers disagreed on the review and a third made the final decision.

Data Extraction

Discrepancies between the two researchers (P.Z.Z. and Y.J.Z.) were discussed until a consensus was reached. A third researcher (M.G.) made the final decision after group discussion if consensus could not be reached. Standardized information tables were developed to extract basic features from each study. The information extracted from each study was as follows: First author, year of publication, age of participants, sample size, intervention protocol, and outcome measures. Two reviewers independently extract data from each study and resolve differences through discussion.

Quality Assessment

Based on the Cochrane risk bias evaluation tool RoB 2 (2019 Revised Edition).[15] The risk of bias was evaluated for all included RCT trials, encompassing the production of random sequences, allocation concealment, blinding design, and other analytical flaws, etc.

Statistical Analysis

In this study, Review Manager 5.4 software was used for meta-analysis of the extracted data. Firstly, I^2 was used to test the heterogeneity of the data. When P <50% was considered to be heterogeneous, the random effect model was selected. When $P \geq 0.05$ and $I^2 \leq 50\%$, there was no heterogeneity, and the fixed effect model was selected. If the heterogeneity is large, subgroup analysis can be performed according to the different interventions to determine the source of heterogeneity. The combined effect size was compared between groups, and $P < 0.05$ indicated that there was a difference in the effect value between the experimental group and the control group. The relative risk (RR) and 95% confidence interval (95% CI) were used as statistics. The clinical effective rate was transformed into binary outcome data (effective/ineffective). The outcome indicators were continuous data such as VAS and NDI scores. Mean difference (MD) and 95% CI were used as statistics. If the unit is different, the standardized mean difference (SMD) and 95% CI are used as statistics to eliminate the unit effect. Publication bias was analyzed by funnel plot and Egger's and Begg's linear regression tests.

Results

Literature Search

A total of 3542 articles were obtained in the initial examination, and 1976 articles were obtained after eliminating duplicate articles. Upon reviewing the complete content, a total of 10 articles were ultimately incorporated.[16–25] Leading up to a total of 624 patients. The literature review procedure and outcomes are illustrated in Figure 2.

Characteristics of the Included Studies

A total of 624 patients with nape back MPS were involved in 10 articles,[16–25] including 309 patients in the experimental group and 315 patients in the control group.

Among them, 5 studies used oral non-steroidal anti-inflammatory drugs as a control group intervention.[20–23,25] 5 studies used other treatment methods (infrared therapy, massage, false dry needle combined with manipulation, visual electromyography biofeedback, and passive stretching) as control measures.[16–19,24] A total of 7 studies used clinical efficacy as a criterion for judging efficacy.[19–25] The VAS score was used as the criterion for efficacy in 5 studies.[17,18,20,23,25] The NDI score was used as the criterion for efficacy in 4 studies.[16,17,20,21] 4 studies used cervical range of motion CROM as a criterion for efficacy.[16–18,21] Table 1 displays the fundamental aspects of the literature included.

Quality Assessment and Risk of Bias

Among them, 5 trials were randomized by random number table method.[20,22–25] 2 trials were randomized by computer and rated as low risk.[16,17] 3 trials did not describe the random method and were rated as unknown risks.[18,19,21] 1 trial performed allocation concealment,[17] and the remaining 9 trials were unknown and therefore rated as unknown risks.[16,18–25] 7 trials did not indicate whether to blind the outcome evaluators and were rated as unknown risks.[19–25] 3 trials only performed blinding on subjects, but considering the feasibility of blinding acupuncture treatment, they were rated as high risk.[16–18] 7 trials did not indicate whether to blind the outcome evaluators and were rated as unknown risks.[19–25] 3 trials indicated that the outcome evaluators were blinded and rated as low risk.[16–18] The conclusions of 10 trials were complete, non-selective reporting of research results, and all were rated as low risk.[16–25] Other biases of all trials were not mentioned, so they were unknown risks (Figures 3 and 4).

Synthesis of Results

The findings of the meta-analysis are encapsulated in Table 2.

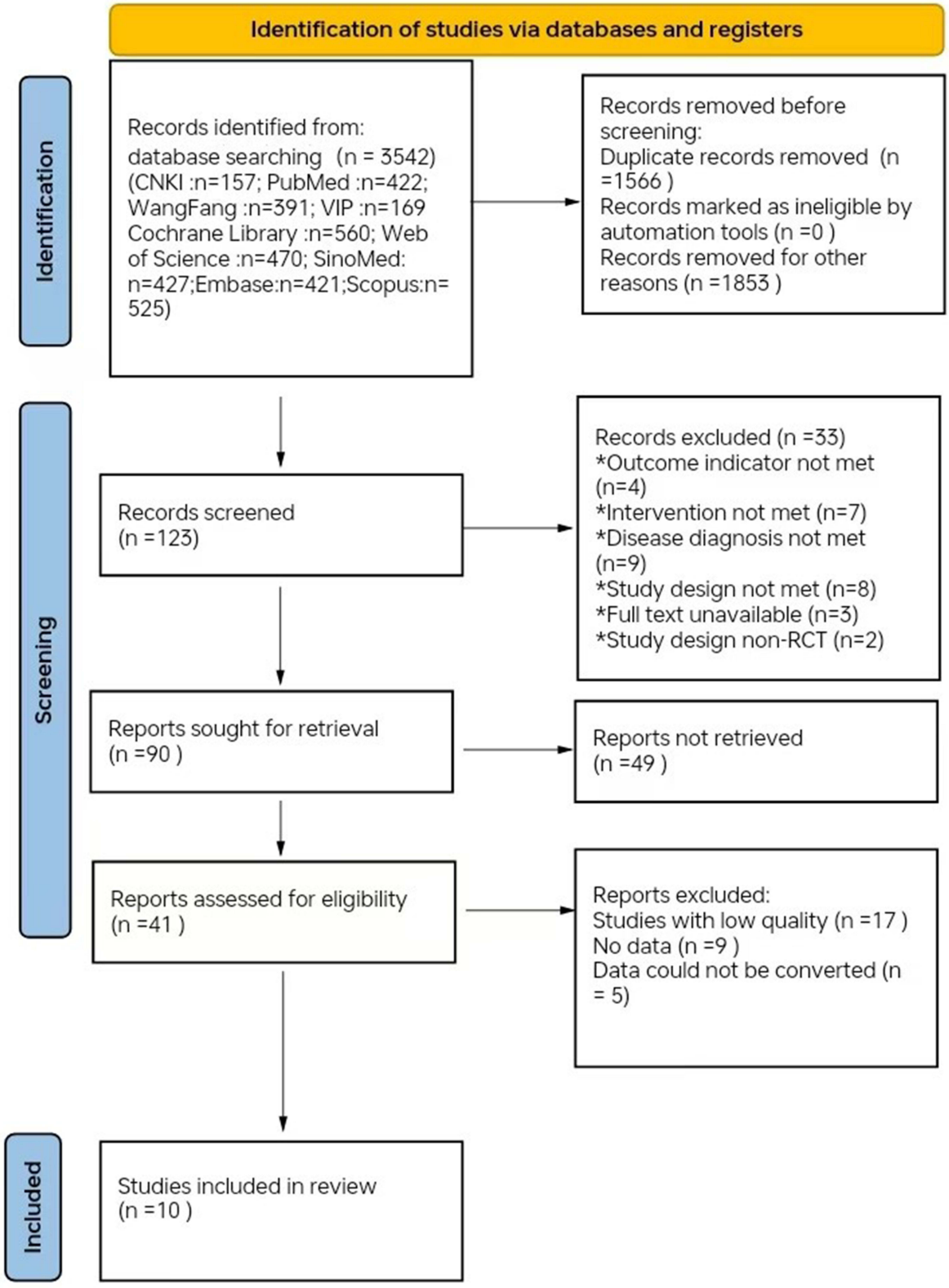

Figure 2 This diagram shows the process of literature screening based on Prisma.

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Table 1 Basic Characteristics of Included Literature

literatures	Diagnostic Criteria Provenance	Number of Examples T/C	Average age T/C	Intervention	Control	Outcome Indicator
YuanXin Lou 2023[18]	Pain science	45/45	45.28±3.41/ 45.24±3.26	Acupuncture with oral non-steroidal anti-inflammatory drugs	Oral NSAIDs	NPQ/NDI/CROM/ Clinical efficiency
SiYu Wu 2017[22]	Massage therapy	30/30	40.13±10.66/ 40.92±11.17	Acupuncture with plantar fascia release method	Oral NSAIDs	VAS/ Clinical efficiency
GuangYun Yu 2014[21]	ChineseTuina Therapy	20/20	40.1± 1.4/ 41.2± 1.1	Acupuncture with massage therapy	Infrared therapy	Clinical efficiency
Guang Yang 2014[16]	Diagnostic Efficacy Criteria for Chinese Medicine Diseases	23/23	39.96±21/ 40.04±20.95	Acupuncture	Massage technique	Clinical efficiency
XinWei Li 2016[17]	Neck and shoulder pain, practical neck and back pain science	35/35	39±7/ 40±3	Floating Needle	Oral NSAIDs	VAS/ pressure-pain score / NDI/ Clinical efficiency
Qi Zhong 2021[20]	Diagnostic Efficacy Criteria for Chinese Medicine Diseases	30/30	53.5 ± 12.8/ 53±10.8	Electroacupuncture with acupoint injection	Oral NSAIDs	VAS/PRI/PPI/ Clinical efficiency
Jing Wang 2014[19]	Diagnostic Efficacy Criteria for Chinese Medicine Diseases	32/32	38.7/40.2	Acupuncture	Oral NSAIDs	Clinical efficiency
Gallego-Sendarrubias 2020[13]	Myofascial pain and dy sfunction:the trigger point manual: upper half of body.	47/53	34.1±7.6/ 34.6±8.9	Dry needling combined with manual therapy	Sham dry needling combined with manual therapy	NPRS/PPT/CROM/ NDI
Eslamian 2020[14]	Comparing biofeedback with active exercise and passive treatment for the management of work-related neck and shoulder pain: a randomized controlled trial.	25/25	39.0±5.5/ 39.0±5.5	Electroacupuncture	Visual electromyography biofeedback therapy	VAS/NDI/CROM PPT
Cerezo-Téllez 2016[15]	Myofascial pain and dysfunction: the trigger point manual: upper half of body.	22/22	≥18/ ≥18	deep dry needling with passive stretch	passive stretch	VAS/PPT/CROM muscle power

Abbreviations: T/C, Treatment Group vs Control Group; NSAIDs, Non-steroidal anti-inflammatory drugs; NPQ, Northwick Park; NDI, Neck Disability Index; CROM, cervical range of motion; VAS, visual analogue scale; PRI, pain rating index; PPI, present pain intensity; NPRS, The Numeric Pain Rating Scale; PPT, pressure pain threshold.

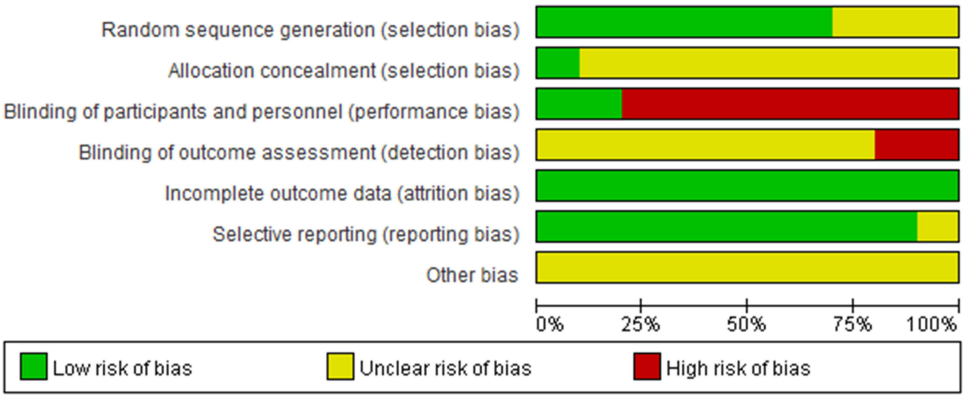

Figure 3 This figure summarizes the risk of bias for articles. In the figure, green represents a low risk of bias, yellow represents the unknown risk of bias, and red represents a high risk of bias. The vertical represents the sources of bias and the horizontal represents the share of low, unknown and high risk of bias.

The Effect of Acupuncture on Clinical Efficiency

A sum of 7 literature outcome indicators included clinical effective rate.[19–25] The statistical heterogeneity between the results of each study was small (P = 0.49, I^2= 0%), and the fixed effect model was used. Meta-analysis results [RR = 1.25, 95% CI (1.15, 1.35), Z = 5.51, P < 0.00001]. The difference was statistically significant (P < 0.01). It shows that the clinical effective rate of acupuncture in the treatment of nape back MPS is better than that of the control group, and the curative effect of acupuncture is better (Figure 5).

The Effect of Acupuncture on VAS

A total of 5 literatures studied the effect of acupuncture therapy on VAS scores.[17,18,20,23,25] Due to inconsistent VAS scoring criteria, SMD was employed for analysis to mitigate the impact of measurement units on the outcomes. The statistical heterogeneity between the groups was high (P = 0.0002, I^2 = 82%), so the random effect model was selected. The findings indicated no substantial difference in the VAS score between the experimental group and the control group (oral non-steroidal anti-inflammatory drugs, low-frequency electrical stimulation, massage, and electromagnetic wave irradiation combined with piroxicam gel)[SMD=−0.21, 95% CI (−0.77, 0.35), Z = 0.74, P = 0.46], see Figure 6. Due to the high heterogeneity, the control group was subjected to subgroup analysis according to oral non-steroidal anti-inflammatory drugs and other treatment methods (low-frequency electrical stimulation, massage, and electromagnetic wave irradiation combined with piroxicam gel). There was no significant difference in VAS score between the experimental group and the oral non-steroidal anti-inflammatory drug control group. [SMD=0.14, 95% CI (−0.62, 0.91), Z = 0.36, P = 0.72]. The VAS score of the experimental group was lower than that of other treatment controls [SMD=−0.71, 95% CI (−1.07, −0.36), Z = 3.94, P < 0.0001] (Figure 7). It is suggested that acupuncture treatment of nape back MPS is superior to other treatment methods in reducing pain, but acupuncture treatment of nape back MPS has no obvious advantage in improving pain compared with oral non-steroidal anti-inflammatory drugs.

The Effect of Acupuncture on NDI

A total of 4 articles studied the effect of acupuncture on the NDI score of nape back MPS.[16,17,20,21] Because of the high statistical heterogeneity among the studies (P = 0.0001, I^2= 86%), the random effect model was used. The results showed that the NDI score of the experimental group was lower than that of the control group [MD = −6.64, 95% CI (−10.95, −2.33), Z = 3.02, P = 0.003] (Figure 8). Due to the high heterogeneity, the control group was subjected to subgroup analysis according to oral non-steroidal anti-inflammatory drugs and other treatment methods (low-frequency electrical stimulation, massage). The results showed that the NDI score of the experimental group was lower than that of the oral non-steroidal anti-inflammatory drug control [MD = −8.73, 95 CI% (−15.23, −2.23), Z = 2.63, P = 0.008]. There was no significant difference between the experimental group and other treatment methods [MD = −3.88, 95% CI (−11.09, 3.32), Z = 1.06, P = 0.29] (Figure 9). It is suggested that acupuncture treatment of nape back MPS is superior to oral non-

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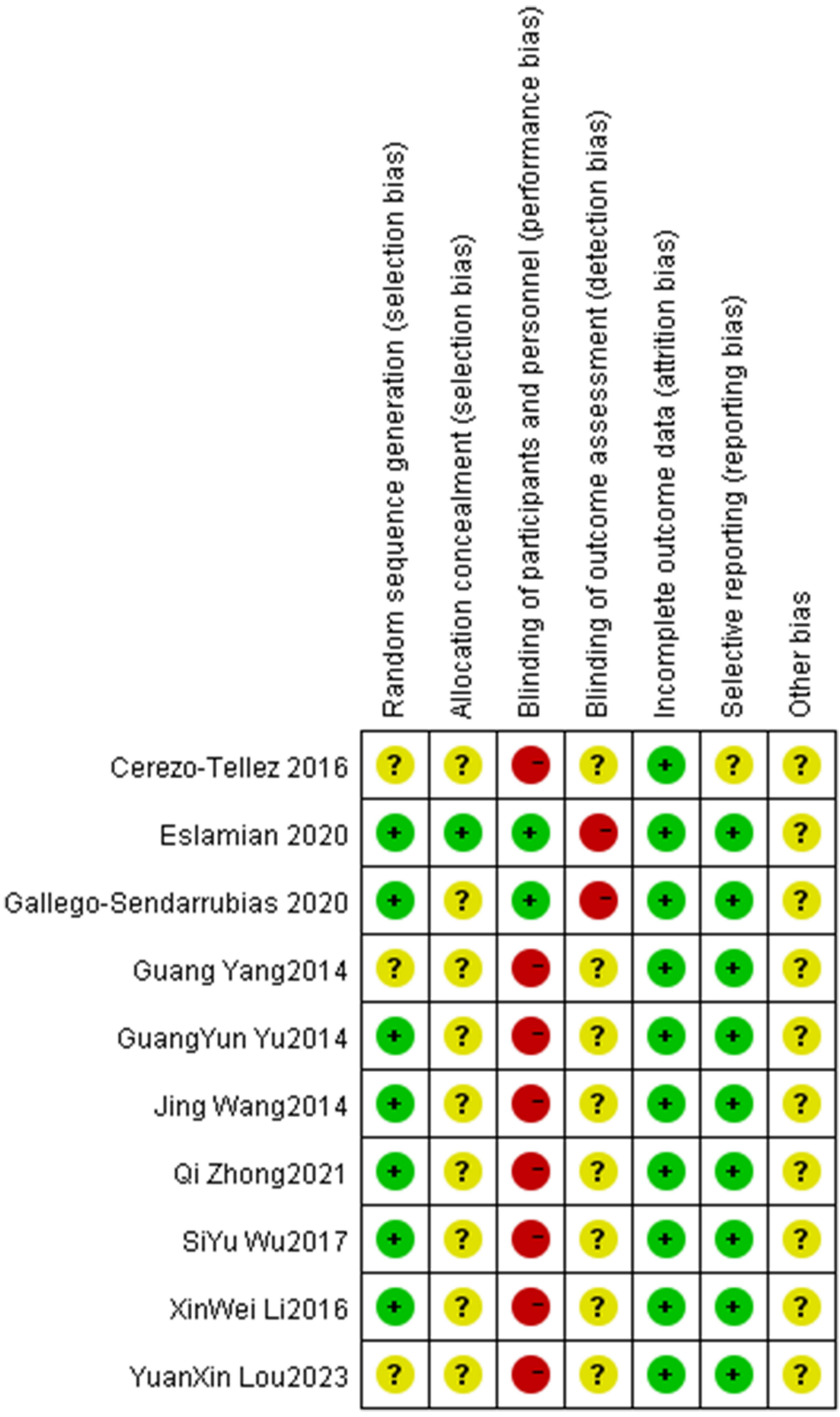

Figure 4 This figure is a graph of the specific bias analysis of the literature included in the study, where the green circles represent low risk of bias, the yellow circles represent unknown risk of bias, and the red circles represent high risk of bias. The vertical represents the name of the included literature and the year of publication, and the horizontal represents the source of risk of bias.

Table 2 Summary Chart of Meta-Analysis Results Included in the Literature

Outcome Indicator	Number of Studies Included	Heterogeneity Test		Effect Model	Meta-analysis Results	
		I^2 %	P value		Effect Size (95% CI)	P value
VAS score	5 (284)	82%	0.0002	Random effects model	SMD=−0.21 (−0.77,0.35)	0.46
NDI score	4 (310)	68%	0.0001	Random effects mode	MD=−6.64 (−10.95, −2.33)	0.003
PPT score	2 (144)	59%	0.12	Fixed effects model	MD=0.95 (0.63,1.27)	P<0.00001
CROM						
Extension ROM	4 (284)	73%	0.01	Random effects mode	MD=1.41 (−2.74,5.57)	0.51
Flexion ROM	4 (284)	65%	0.04	Random effects mode	MD=2.39 (−0.88,5.66)	0.15
Right lateral flexion ROM	2 (150)	0%	0.33	Fixed effects model	MD=4.86 (1.61,8.12)	0.003
Left lateral flexion ROM	2 (150)	90%	0.002	Random effects mode	MD=1.18 (−8.44, 10.81)	0.81
Rotation ROM	2 (134)	0%	0.7	Fixed effects model	MD=0.52 (0.43, 0.61)	P<0.00001
Right rotation ROM	1 (100)			Fixed effects model	MD=5.41 (0.97, 9.85)	0.02
Left rotation ROM	1 (100)			Fixed effects model	MD=4.75 (0.53, 8.97)	0.03
PPT	2 (144)	59%	0.12	Fixed effects model	MD=0.95 (0.63, 1.27)	P<0.00001
Right rhomboid PPT	1 (50)			Fixed effects model	MD=0.23 (−0.22, 0.68)	0.32
Left rhomboid PPT	1 (50)			Fixed effects model	MD=−0.03 (−0.56, 0.5)	0.91
Right upper TraPs PPT	1 (50)			Fixed effects model	MD=−0.35 (−0.68, −0.02)	0.04
Left upper TraPs PPT	1 (50)			Fixed effects model	MD=−0.33 (−0.61, −0.05)	0.02
Right lower TraPs PPT	1 (50)			Fixed effects model	MD=−0.35 (−0.77, 0.07)	0.1
Left lower TraPs PPT	1 (50)			Fixed effects model	MD=0.17 (−0.32, 0.66)	0.5
Right Paravertebral PPT	1 (50)			Fixed effects model	MD=−0.03 (−0.38, 0.32)	0.86
Left paravertebral PPT	1 (50)			Fixed effects model	MD=−0.35 (−0.76, 0.06)	0.1
PRI score	1 (60)			Fixed effects model	MD=−1.09 (−1.86, −0.32)	0.005
PPI score	1 (60)			Fixed effects model	MD=−0.4 (−0.71, −0.1)	0.01
NPQ score	1 (90)			Fixed effects model	MD=−8.51 (−10.03, −6.99)	P<0.00001

Abbreviations: SMD, Standardized Mean Difference; MD, Mean Difference.

steroidal anti-inflammatory drugs in improving cervical dysfunction. Acupuncture has no obvious advantage in improving cervical dysfunction compared with other therapies.

The Effect of Acupuncture on CROM

Four articles studied the effect of acupuncture therapy on cervical joint mobility.[16–18,21] Four articles studied flexion and extension, two articles studied rotation and left and right lateral flexion and one article studied left and right rotation. The heterogeneity between studies of extension (I^2= 73%, P = 0.01), flexion (I^2= 65%, P = 0.04), and left flexion (I^2= 90%, P = 0.002) was large, so the random effect model was used. The heterogeneity between rotation (I^2= 0%, P = 0.7) and right flexion (I^2= 0%, P = 0.33), left and right rotation studies was small, so the fixed effect model was selected. The findings indicated that acupuncture might markedly enhance the range of motion in right cervical flexion [MD = 4.86, 95% CI (1.61,8.12), Z = 2.93, P = 0.003], rotation [MD = 0.52, 95% CI (0.43, 0.61), Z = 11.39 P < 0.00001] and left and right rotation (p < 0.05). However, there was no significant improvement in cervical extension [MD = 1.41, 95% CI

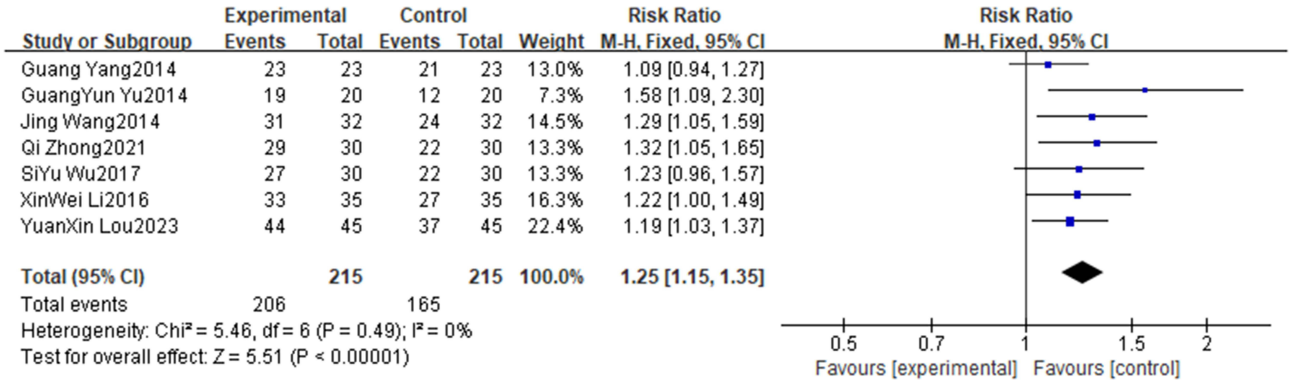

Figure 5 This figure shows a forest plot of the efficiency of acupuncture for the treatment of nape back myofascial pain syndrome. The effect indicator is the RR value (risk ratio), and the combined RR value is 1.25, with a 95% confidence interval of 1.15~1.35, which is better in the acupuncture group compared to the control group ($p < 0.00001$). The outcome index is effective or ineffective for acupuncture, the square indicates the weight size, the horizontal line where the square is located indicates the 95% confidence interval of the RR value, the diamond represents the combined effect value, and the vertical line represents ineffective.

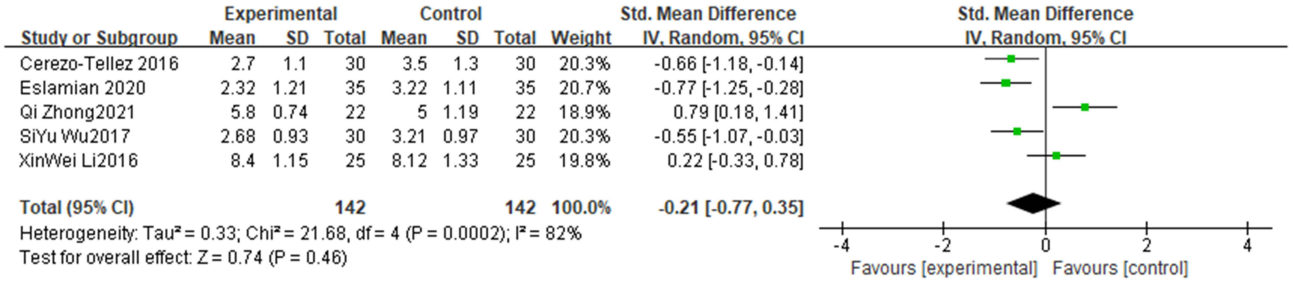

Figure 6 The effect of acupuncture on VAS scores, with the effect indicator being the SMD value (standardized mean difference), had a combined SMD value of −0.21, with 95% confidence intervals ranging from −0.77 ~ 0.35, and was not statistically significant in the acupuncture group compared to the control group (P=0.46 > 0.01). The ending indicator is the increase or decrease of the VAS score, the square indicates the weight size, the horizontal line where the square is located indicates the 95% confidence interval of the SMD value, the diamond represents the effect value of the merger, and the vertical line represents the ineffective.

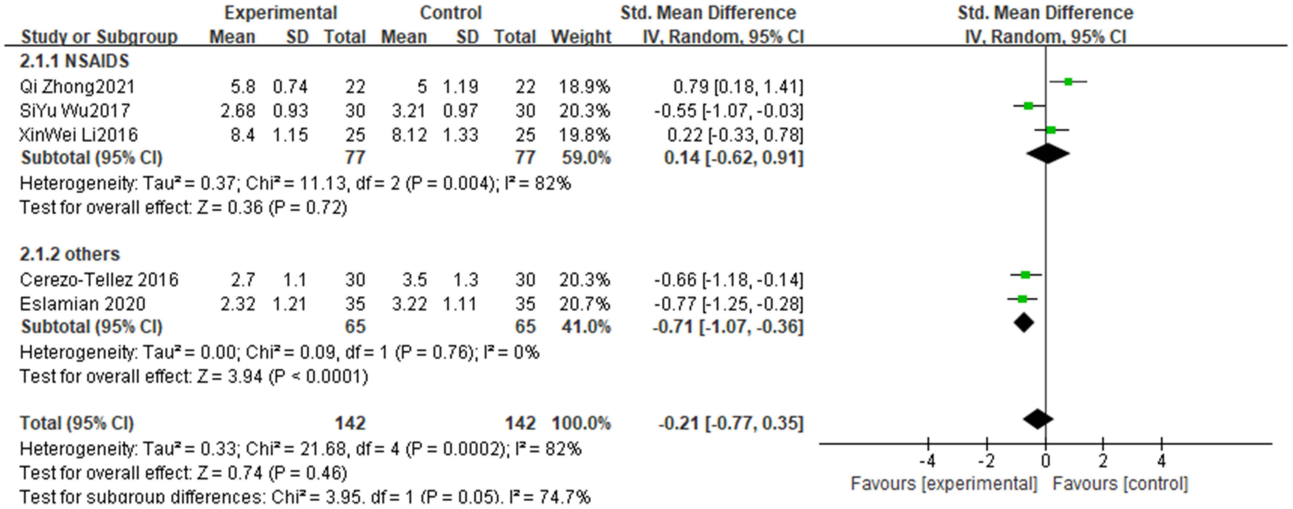

Figure 7 The effect of acupuncture on VAS scores, with the effect indicator being the SMD value (standardized mean difference), had a combined SMD value of −0.21, with 95% confidence intervals ranging from −0.77~0.35, and was not statistically significant in the acupuncture group compared to the control group (P=0.46 > 0.01). The ending indicator is the increase or decrease of the VAS score, the square indicates the weight size, the horizontal line where the square is located indicates the 95% confidence interval of the SMD value, the diamond represents the effect value of the merger, and the vertical line represents the ineffective.

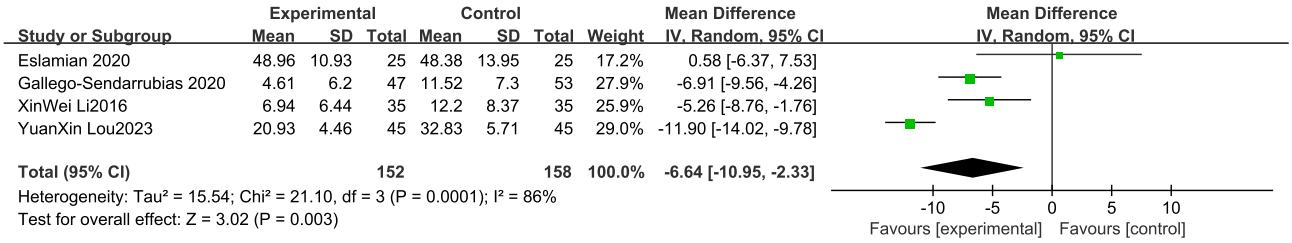

Figure 8 The effect of acupuncture on NDI scores, with the effect indicator being the MD value (mean difference), had a combined MD value of −6.64, with a 95% confidence interval of −10.95 ~-2.33, and the NDI scores in the test group were lower than those in the control group (p=0.003). The outcome indicator was higher or lower NDI scores, with squares indicating the magnitude of the weights, the horizontal line where the square is located indicating the 95% confidence interval of the RR value, the diamond representing the combined effect value, and the vertical line representing the null.

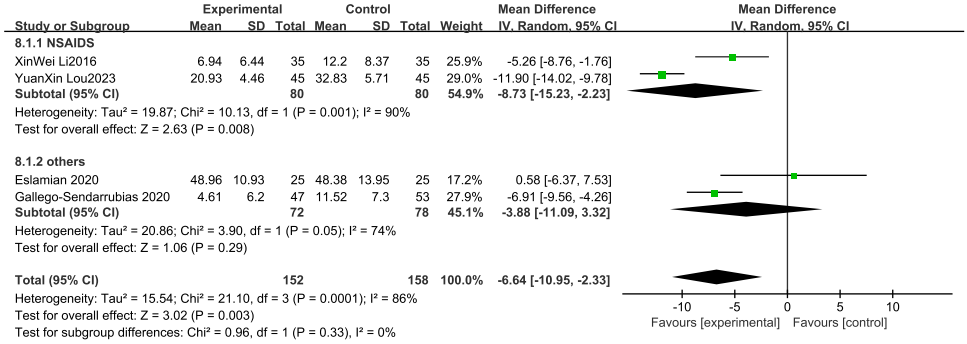

Figure 9 In the subgroup analysis of NDI scores, the effect indicator was the MD value (mean difference), and the combined MD value was −6.64, with a 95% confidence interval of −10.95 to −2.33. The efficacy of the acupuncture group was comparable to that of other therapies except for oral NSAIDs, without statistical significance (P=0.29>0.01); NDI scores of the experimental group were lower than that of the control group taking oral NSAIDs (P=0.001). The outcome indicator is an increase or decrease in the NDI score; squares indicate the magnitude of the weights, the horizontal line where the squares are located indicates the 95% confidence interval of the RR value, the diamonds represent the combined effect value, and the vertical line represents the null.

(−2.74, 5.57), Z = 0.67 P = 0.51], flexion [MD = 2.39, 95% CI (−0.88, 5.66), Z = 1.43 P =0.15], left flexion [MD=1.18, 95% CI (−8.44, 10.81), Z = 0.24 P = 0.81]. See Table 2.

The Effect of Acupuncture on PPT

Two articles studied the improvement effect of acupuncture therapy on PPT in patients with nape back MPS.[17,18] The heterogeneity between studies was small (I^2= 59%, P = 0.12), so the fixed effect model was used. A literature study on the effect of acupuncture therapy on left and right rhomboid muscle PPT, left and right upper trapezius muscle PPT, left and right lower trapezius muscle PPT, and left and right paravertebral PPT in patients with nape back MPS.[17] The results showed that acupuncture could improve the tenderness threshold of patients with nape back MPS [MD=1.18,95% CI (−8.44, 10.81), Z = 0.24, P = 0.81], PPT of left upper trapezius and PPT of right upper trapezius (P < 0.05) and reduce pain sensitivity for pain relief in patients with dorsal collateral musculoskeletal fasciitis. However, there was no conclusive evidence that acupuncture could improve the left and right rhomboid PPT, left and right lower trapezius PPT, and left and right paravertebral PPT (P > 0.05) (Table 2).

Acupuncture Safety Study

No related adverse reactions were reported in 8 articles.[16–19,22–25] 2 articles reported adverse reactions.[20,21] One of the studies showed that there were 3 adverse reactions in the experimental group, including gastrointestinal discomfort, needle sticking, and dizziness and 1 in the control group had gastrointestinal adverse reactions, but the causes of adverse reactions were not explained. In another study, only 1 person in the experimental group had adverse reactions, which were caused by the patient's non-compliance with the doctor's advice. A total of 3 people in the control group had gastrointestinal adverse reactions. The findings indicate that the safety of acupuncture therapy is superior.

Heterogeneity Analysis

Calculated by Revman software, the heterogeneity of clinical effectiveness rate was low ($I^2 = 0\%$, $P = 0.49$), and after excluding any study, the RR value remained 1.20 –1.30, $P < 0.001$, and the results were highly robust, indicating that it suggested that the overall efficacy of the acupuncture group was better than that of the control group. The heterogeneity of the VAS scores was high ($I^2 = 82\%$, $P = 0.0002$), which indicated that there was a significant difference between the different. There were significant differences between studies and no overall statistical significance, considering the mixed interventions in the control group, a subgroup analysis was performed, with no statistical significance in the oral NSAIDs group $P = 0.72$, and $P < 0.0001$ in the other treatment groups, suggesting that acupuncture analgesia was superior to non-pharmacological therapies, such as low-frequency electrical stimulation and acupressure. Combining the results, consider that the heterogeneity in VAS scores originated from differences in interventions in the control group, differences in the timing of VAS assessment, and differences in acupuncture points as well as manipulation. The results of the NDI study showed high heterogeneity ($I^2 = 86\%$, $P = 0.0001$) suggesting that there was a significant difference between the studies. Considering that it may be due to differences in interventions in the control group, subgroup analyses were performed and the group taking oral NSAIDs $P = 0.008$, heterogeneity was not reported, other treatment control subgroup $P = 0.29$, combined with the above results, it was hypothesized that the source of heterogeneity may be due to different mechanisms of action of medication and physiotherapy in the control group, differences in parameters of the needle manipulation, differences in the baseline characteristics of the included cases, and time of measurement of NDI scores. There were three high heterogeneity extensions ($I^2 = 73\%$), flexion ($I^2 = 65\%$), left lateral flexion ($I^2 = 90\%$) two low heterogeneity rotations ($I^2 = 0\%$), right lateral flexion ($I^2 = 0\%$) in the results of cervical spine joint mobility, due to the small sample size could not be analyzed in subgroups; it is speculated that the heterogeneity may be mainly due to the small sample size, the measurement methodology, and the results of the error. Combined results of two PPT score studies ($I^2 = 59\%$, $P = 0.12$) moderate heterogeneity, probably due to small sample size resulting in large fluctuation of test results and high heterogeneity. Due to the limited number of included studies that could not be further regression analyzed, it is speculated that the heterogeneity may be derived from the small sample size, different measurement locations, and different measurement processes as well as methods.

Sensitivity Analysis

To test the robustness of the findings, we conducted sensitivity analyses of the outcome indicators using recalculation of the combined effect sizes after excluding individual studies one by one, changing the effects model, and excluding studies at high risk of bias. The results showed that the outcomes of clinical effectiveness and cervical rotation mobility were stable. The combined outcomes of the VAS score and PPT were slightly less stable, and the conclusions may have been influenced by individual studies. The results of high heterogeneity indicators such as cervical extension and flexion were unreliable.

Risk of Bias

Stata 18.0 was used to draw a funnel plot with the abscissa of RR and the ordinate of logRR based on the clinical efficiency with the largest number of applied literature, and the publication bias was detected. If the distribution of the figures on both sides of the figure is uneven, it is suggested that there may be publication bias. See Figure 10. However, due to the small amount of literature included in this study, the validity of the test of funnel plot symmetry was low.

Discussion

Acupuncture is a non-drug therapy for MPS (MPS) in traditional Chinese medicine. It is performed after acupuncture is inserted into a specific acupoint of the body.[26] Clinical evidence indicates that acupuncture provides short-term clinically significant advantages in alleviating pain and enhancing function relative to sham therapy, placebo, standard treatment, or alternative therapies.[27–33] Research on the pain mechanism in contemporary acupuncture indicates that its analgesic action stimulates both peripheral and central pain control systems through the release of numerous endogenous opioid or non-opioid substances. Extensive data indicates that acupuncture stimulates peripheral and central pain modulation

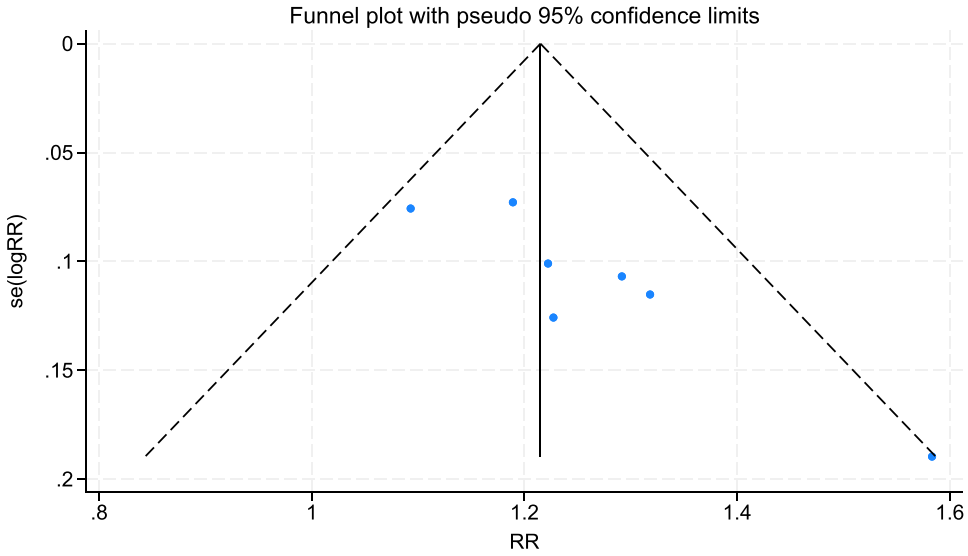

Figure 10 The vertical line in the middle of this figure indicates the combined effect size, the slanted dotted lines on both sides are the 95% confidence intervals, the circles represent the included studies, the horizontal axis coordinates indicate the effect sizes, and the vertical axis coordinates indicate the log standard errors of the effect sizes, and the uneven distribution of the circles on both sides shown in this figure suggests that there may be publication bias.

mechanisms, resulting in pain relief.[34] Acupuncture has a good effect on myofascial pain, so some researchers believe that acupuncture treatment of MPS is a good alternative to the existing treatment methods.[35] Our meta-analysis showed that acupuncture treatment in the experimental group was significantly better than other treatment options in the control group. The advantages of acupuncture treatment are lower NDI and VAS scores, more obvious improvement of tenderness threshold, better improvement of cervical joint mobility, and higher treatment effect in the experimental group. The above differences are statistically significant. To ensure the accuracy of the analyzed results, heterogeneity analysis was performed for the outcome indicators, subgroup analysis was performed according to different interventions in the control group, and by comparing the treatment protocols in the control group and acupuncture group to explore whether the differences in the control group would affect the reliability of the results, and the results demonstrated that the acupuncture treatment had a better effect in relieving the pain of collar dorsal myofascial pain syndrome compared with other therapies that were not drugs. To ensure the stability of the analyzed results, sensitivity analyses as well as publication bias assessments were performed for the relevant indicators. Acupuncture treatment for the dorsal collar myofascial pain syndrome has significant advantages in increasing clinical efficiency and improving cervical rotation and right lateral flexion mobility, and the results are solid, while the solidity of the conclusions for other indicators needs to be improved due to high heterogeneity and publication bias. In terms of safety, it is worth noting that two studies have reported adverse reactions to acupuncture and other therapies, indicating that the safety of acupuncture treatment remains to be further studied.

Study Limitations

While our findings indicate that acupuncture is superior to other therapies in treating nape back MPS, it must be acknowledged that there are still some limitations in our study: ① Although these ten studies included are RCTs, due to the difficulty of acupuncture treatment for double-blind implementation, and some trials have non-standard random methods, there is a certain probability of implementation bias. ② In the included research papers, the efficacy evaluation is mainly carried out through various scores, but the patient's subjective consciousness is more, and there is no objective data to measure it. ③ This study also included other outcome indicators, such as PPI, NPQ, PRI, etc. However, the number of studies on these related indicators is small. Additionally, further high-quality randomized controlled trials with substantial sample sizes are required. ④ This study exclusively compared the meta-analysis results with those of analogous research. The absence of a study on the mechanisms by which acupuncture alleviates MPS in the nape precludes a comprehensive biological explanation of the results. ⑤ The lack of literature, insufficient sample size, low

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quality of literature, baseline differences between studies, and publication bias may cause a certain degree of error and bias in the data interpretation of this study. All 10 included literature was found that the main reason for the low quality of the included literature was that the researchers paid less attention to the risk of bias, such as allocation concealment and blindness, resulting in the lack of relevant data description. The above reasons will have different degrees of interference with the accuracy of data analysis.

Conclusions

This study shows that acupuncture is effective for nape back MPS. The amount of literature included is small and of low quality, lacking large-scale subjects, and the outcome indicators are mostly subjective evaluations; therefore, rigorous, larger-sample, and more reliable clinical practice studies are needed in the future to further validate the findings of this study. It is recommended to further explore the standardized and optimized intervention protocol of acupuncture for the treatment of nape back MPS to provide a more reliable evidence-based basis for treatment.

Data Sharing Statement

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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Disclosure

The authors declare that there is no conflict of interest in this work.

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