

# Interventions for Treating Tennis Elbow: An Overview of Systematic Reviews in the Past Ten Years

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## Methodology

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# Abstract

**purpose:** Tennis elbow is a common orthopedic disease, and there are many ways to treat it. This overview aimed to summarize the evidence of different treatments for tennis elbows, so as to provide the best guidance for clinical treatment.

**Methods:** Use computer to search CNKI, WanFang database, WeiPu database, CBM database, PubMed, Cochrane Library and Embase from the time of establishment to May 31, 2019. The Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) and latest Assessment of Multiple Systematic Reviews 2 (AMSTAR2) checklists were used to assess reporting characteristics and methodological quality, respectively.

**Results:** A total of 37 references were included. Methodological quality and reporting quality were unsatisfactory. Methodological quality was generally low and many key items were not reported. Some research reports are of high quality, but there is no trial registration and protocol written in advance, which may lead to some bias in the research process. The most frequent problems included non-registration of study protocol, absence of a list of excluded studies, and unclear acknowledgment of conflicts of interests. The different types of interventions included have been shown to relieve pain, improve quality of life, and restore elbow function, but there has been a lack of comparative studies.

**Conclusion:** The reporting and methodological quality of systematic reviews and meta-analysis studies were sub-optimal, which demands further improvement. Comparative studies of different types of interventions are needed to determine unclear.

**PROSPERO registration number:** CRD42015017071

## 1. Background

Tennis elbow is also known as Lateral epicondylitis, is a sterile inflammation of the extensor muscle tendon of the external humeral epicondylitis and one of the most common occupational diseases of the musculoskeletal system<sup>[1]</sup>. Its clinical manifestations are pain of the lateral elbow. Local pain is aggravated when grasping, lifting objects or rotating wrist flexion, and radiates to the lateral forearm, affecting daily life<sup>[2]</sup>. Epidemiological data showed an incidence of tennis elbow between 1 and 2%. The prevalence of tennis elbow in women between 40 and 50 years of age was 10%<sup>[3]</sup>. The majority of cases are female and more female than male<sup>[4]</sup>. Tennis elbow is a self-limiting disease with symptoms lasting from 6 months to 2 years<sup>[5]</sup>. At present, there are many clinical methods to treat tennis elbow, including non-invasion and invasion. Non-invasion treatments include a myriad of options, including rest, nonsteroidal anti-inflammatory drugs, physical therapy, cortisone, blood and botulinum toxin injections, supportive forearm bracing, and local modalities. Invasion treatments include open débridement technique, arthroscopic or percutaneous procedures<sup>[6]</sup>. In the past, the most commonly used injection therapy was corticosteroid injection. In recent years, the injection therapies developed include autologous blood therapy, botulinum toxin A therapy and autologous platelet-rich plasma therapy<sup>[7, 8, 9]</sup>. The effect of extracorporeal shock wave therapy is similar to that of traditional ultrasonic therapy for tennis elbow. ESWT can be used as an alternative to ultrasound<sup>[10]</sup>. Elbow orthotics can improve elbow symptoms, reduce pain and improve patients' quality of life<sup>[11]</sup>.

External humeral epicondylitis is a common clinical elbow joint disease with local pain of external humeral epicondylitis as the main symptom. Its pathological cause and pain mechanism are still unclear. Tendon repeated to load, excessive strain. Compared with muscles, tendons lack blood supplied. When muscles contract repeatedly for a long time, tendons are prone to ischemia and produce reperfusion injury such as oxygen free radicals, which leads to tendon degeneration<sup>[12]</sup>. Substance P (SP) is an excitatory neurotransmitter released by pain afferent nerve endings, and one of the products of nerve sensitization. SP can transmit pain information, produce pain and analgesic effects, and its release is closely related to local neurogenic inflammation<sup>[13]</sup>. Nerve entrapment may be the cause of epicondylar pain outside the humerus. The extensor general tendon, especially the extensor radialis brevis, may compress the posterior ramus of the radial nerve<sup>[14]</sup>. The fear of pain caused by tendon defects can also cause severe pain in external epicondylitis. Prolonged exposure to low-stress activities due to underuse or stress shielding may also lead to tendon weakness and increased vulnerability to injury<sup>[15]</sup>.

Darby A. Houck et al.<sup>[16]</sup> conducted systematic review and overview on three different injection therapies, and the results showed that the short-term efficacy of corticosteroid injection was better, and the overall effect of autologous blood therapy and platelet-rich therapy were better, but the dosage and frequency of injection still affected the treatment results, and further research was needed.

Many systematic reviews have shown the evidence for what works, what does not work, what could be harmful, and where more research is needed. Our aim is to evaluate the available evidence from systematic reviews on the effectiveness of interventions for tennis elbow.

## 2. Materials And Methods

2.1. Protocol and Registration. This system review has been registered on the PROSPRO platform with the registration number as CRD42015017071.

2.2. Search Strategy. We searched seven major databases, including four Chinese databases (CNKI, WF, VIP and CBM) and three English databases (PubMed, EmBase and Cochrane Library). The retrieval period was from the earliest record of May 30, 2019, and the publication time and language is not restricted. Search keywords included "tennis elbow," "lateral epicondylitis," "external humeral epicondylitis," "system review," and "meta-analysis." See the registration plan for specific search strategies. 2.3. Inclusion Criteria. (1) Study Design: systematic review or meta-analysis of RCT or NRSI involving multiple studies. (2) Study Participants: Patients with tennis elbow were clearly diagnosed, regardless of age, course and source of cases. (3) Study Intervention: non-invasion treatment and invasion treatment, non-interventional treatments include nonsteroidal anti-inflammatory drugs, physical therapy, autologous blood (AB), botulinum toxin A (BT), autologous platelet-rich plasma (PRP), Elbow orthosis, extracorporeal shock wave therapy, etc. Interventional treatments include open debridement technique, arthroscopic or percutaneous procedures. (4) Study Comparison: Other interventions, included western medicine, other

acupuncture, Treatment of local block, placebo etc.(5)Outcome Measures: Main outcome(s): Pain relief, global improvement, and functional improvement.Secondary outcome measures: visual analogue scale(VAS), Disabilities of the ArmShoulderand Hand(DASH) scores, effective rate and adverse reactions. 2.4.Exclusion Criteria. (1)Duplicate checked literature.(2)Literature that did not meet the inclusion criteria.(3)Republish literature.(4)Conference papers, without full text.(5)A paper published 10 years ago.(6)Net-work meta analysis. 2.5.Literature Screening and Data Extraction. Basing on the inclusion and exclusion criteria formulated by this study, two researchers(YJ.YT) independently read the titles and abstracts of the literature found and conducted the preliminary screening, excluding the studies that obviously did not meet the inclusion criteria, and then read the full text to select the studies that met the standards for data extraction.If the same study is reported by different literature for many time, the most detailed was selected to be included in the study.Data extraction contents included author, year, publishing unit, the literature evaluation tool, literature type, sample size, intervention measures, included a research type, outcome index, etc.Both researchers independently screened the literature and extracted data, and then cross-checked them.If there were any inconsistent studies, the third researcher decided whether or not to include them or not after discussion. 2.6.SRs Methodological Quality Assessment. Methodological quality evaluation is used to evaluate internal authenticity, while reporting quality evaluation is used to evaluate external authenticity.AMSTAR2[17](A Measure Tool to Assess Systematic Reviews 2) a methodological quality assessment tool for SRs.AMSTAR2 is updated on the basis of AMSTAR, which is applicable not only to the systematic review of randomized controlled studies, but also to the systematic review of non-randomized intervention studies.AMSTAR2 has 16 entries, with 7 key entries as a recommendation level(Table1)."Yes", "no" and "partially yes", according to the compliance. A general rule was applied for rating overall confidence in the results of review: SR with no or one noncritical weakness was rated as high;with more than one noncritical weakness was rated as moderate;with one critical flaw with or without noncritical weaknesses was rated as low;with more than one critical flaw with or without noncritical weaknesses was rated as critically low. In addition, PRISMA[18] was a reporting quality assessment tool for evaluating SRs, with 27 entries.Rated as "yes" and "no" according to whether they are in conformity or not. All articles that meet the requirements were evaluated by two reviewers using the above two assessment tools, and the two reviewers discussed and decide upon the differences.

Table1 AMSTAR2 key items	
Critical domain	Context
Item 2	Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any signifcant deviations from the protocol?
Item 4	Did the review authors use a comprehensive literature search strategy?
Item 7	Did the review authors provide a list of excluded studies and justify the exclusions?
Item 9	Did the review authors use a satisfactory technique for assessing the risk of bias (ROB) in individual studies that were included in the review?
Item 11	If meta-analysis was performed did the review authors use appropriate methods for statistical Item 11 combination of results?
Item 13	Did the review authors account for ROB in individual studies when interpreting/discussing the results of the review?
Item 15	If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?

### 2.7.Data synthesis.

All data were included in the Excel 2016 table, and the number and percentage of papers satisfied by each item were calculated.

## 3. Results

### 3.1Results of the literature search.

A total of 234 articles were found in the literature retrieval.And 73 were repeated.After reading the questions and abstracts, one article was published repeatedly, 67 of which did not meet the inclusion and exclusion criteria, and 47 of which were published 10 years ago.After looking at the full text, there were 6 conference papers, 2 without full text, and 1 article with incomplete data.37 SR papers were listed in this overview(Figure 1).

### 3.2Description of the included reviews.

The main characteristics of the included SRs were presented in table 2.Among the included studies, there were 15 in China and 22 in English, among which 2 in China were actually the same study.The one with the most complete description was chosen for evaluation.Twenty-nine of the studies included were randomized controlled trials, and 21 were assessed for bias using Cochrane's risk bias assessment tool.Seven was assessed using the Jadad scale, and three were assessed using the PEDro score.Ten literature was reviewed systematically, and 27 were meta-analyzed.Interventions, 12 articles used acupuncture, 4 using the shock wave therapy, 14 with non-surgical therapy, including platelet rich plasma, botulinum toxin injection, autologous blood injection, corticosteroid injections, etc.3 article adopting physical therapy, 4 by operation therapy.See Table 2 for full details.

### 3.3.Assessment of methodological quality and quality of evidence

#### 3.3.1.Methodological quality

Table 3 shows the methodological quality assessment results of the included reviews.According to the latest AMSTAR2 evaluation criteria, since all SRs had more than one critical weakness (Items 2, 4, 7, 9, 11, 13, and 15), their quality was considered as critically low.

They all employed the PICO approach (population, intervention, control group, and outcome) as an organizing framework for establishing study questions. Most of the included studies adopted the elementary rule of PICO, including 5 non-random, cohort and case-control studies, and the rest were included in RCT. Only 1 article<sup>[54]</sup> provides protocol registration, and the rest do not provide protocol registration or publication before commencement of the review (AMSTAR2 Item 2). Two SRs<sup>[38, 44]</sup> described the reasons for the type of included study, while none of the others described the reasons for the type of included study (AMSTAR2 Item 3). Only one review<sup>[48]</sup> had conducted a comprehensive literature search. One review<sup>[53]</sup> only retrieves one database, which is not inclusive enough (AMSTAR2 Item 4). In two reviews<sup>[41, 44]</sup> authors had not performed study selection and data extraction in duplicate. None of the reviews provided a complete list of potential related studies and reasons for excluding each (AMSTAR2 Item 7). Thirty seven reviews partly provided characteristic information of their included studies. Three SRs<sup>[35, 41, 53]</sup> did not evaluate the risk of the included studies, while the rest of them evaluated the quality of the included literature with different scales. Three SRs<sup>[23, 32, 54]</sup> had reported funding sources for the included studies and whether there is a conflict of interest between the included studies, while the rest are not reported. Twelve reviews<sup>[22, 27-28, 29-30, 38-39, 41, 43, 45-47]</sup> applied meta-analytical methods appropriately, explaining factors for fixed or random effects model selection and methods used for heterogeneity investigation. Eleven reviews<sup>[32, 35, 37, 42, 44, 50, 52-55]</sup> were only described qualitatively without meta-analysis (AMSTAR2 Item 11). Two reviews<sup>[29, 51]</sup> described the potential impact of the quality of the included studies on the results of evidence synthesis, while the rest were not described. Nineteen reviews<sup>[19, 23, 25-26, 28, 30-31, 33, 34, 36, 38-40, 42-43, 45-52, 54]</sup> had discussed the impact of quality assessment in results interpretation of the review (AMSTAR2 Item 13). Seventeen reviews<sup>[22, 24, 27-28, 35-36, 38-39, 41, 43, 45-47, 51, 53-55]</sup> had explored possibilities of heterogeneity and discussed its influence on the results conclusions and clinical recommendations. Twelve reviews<sup>[19-20, 22-23, 25-28, 33, 39, 48-49]</sup> only investigated publication bias, but did not describe the causes of publication bias and its impact on results (AMSTAR2 Item 15). Twelve reviews<sup>[20, 23, 25-26, 28, 30-31, 37-39, 41, 52]</sup> didn't describe funding sources or conflicts of interest.

### 3.3.2 Reporting Quality.

The results of the assessment on the reporting of included reviews were presented in Table 4 and Figure 2. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) were applied to assess report quality of included SRs. In all the review topics, it was clearly stated that they were systematic evaluation, meta-analysis, or both. All of them adopted the abstract of structural formula, described the disease burden and clinical symptoms, and proposed clear research problems to be resolved. One review<sup>[54]</sup> reported the trial registration number, and 48.75% provided a complete retrieval method for at least one database. And 86.94% reported risk bias assessments. 8.11% reported whether there were other methods for meta-analysis, 91.89% reported the literature flow chart, 70.27% summarized the main findings of the study, 75.68% discussed the limitations and risks of bias in the outcome level, and 72.97% reported the sources of funding and the role of funder in completing the systematic review.

### 3.4. Efficacy of the interventions

#### 3.4.1. VAS

Twenty-five SRs included VAS as an outcome measure. Of these SRs were conducted meta-analyses. The intervention methods are: Seven SRs using acupuncture and moxibustion treatment of tennis elbow, four SRs with shock wave therapy, two pieces of SRs used botulinum toxin injection treatment, one SR used autologous blood treatment, one SR with Platelet rich plasma therapy treatment with 1 piece of corticosteroid injection, 2 SRs adopted physical therapy, 1 piece of SR with Saline Injections of treatment, For the SR, low-level laser therapy (LLLT) was used in 1 paper, Percutaneous Needle Tenotomy was used in 1 paper, non-surgical therapy was used in 1 paper, and surgical therapy was used in 3 papers. All the results showed that it could effectively relieve pain.

#### 3.4.2 Effectiveness of different interventions

Eight SRs (89 RCTs, 6992 participants) included effective rate as an outcome measure. The intervention measures include fire needle, warm acupuncture, floating needle, small needle knife, massage, acupuncture, extra corporeal shock wave therapy, etc. Most of them are acupuncture and moxibustion, and the results all show that acupuncture and moxibustion can improve the effective rate of treating tennis elbow and reduce the adverse reactions.

#### 3.4.3 Adverse Events.

Only five studies reported adverse events, The intervention measures with small needle knife, acupuncture, botulinum toxin injections, autologous blood injection, platelet rich plasma, etc., adverse reactions are fainting during acupuncture treatment, extensor weakness, pain at the injection site, and paresthesia.

## 4. Discussion

### • Summary of Main Findings.

Overview is a comprehensive research method that comprehensively collects systematic reviews related to the treatment, etiology, diagnosis and prognosis of the same disease or health problem for reevaluation<sup>[56]</sup>. This overview has provided a summary of the effects on pain improvement and functional relief among patients with tennis elbow treated by different interventions in thirty-seven eligible SRs. This overview included RCT, cohort studies, and Case series. This overview included Twenty-five meta-analyses and twelve narrative SRs. The majority of SRs were considered as relatively high reporting quality and critically low methodological quality, by using the PRISMA and AMSTAR2 tools, respectively.

### 4.2. Suggestions for Better Methodological and Reporting Quality.

In this overview, all 37 SRs employed PICO approach in organizing research question and describing inclusion criteria but only one review has provided a documented protocol or register information. It is noted that obtaining an open register of a SR in advance is quite essential for conducting a SR. It can help

facilitate processing transparency and avoiding post hoc decision bias in methodology<sup>[57]</sup>,The register item has also been recorded in both the PRISMA and AMSTAR2 checklists,indicating its great importance.In summary,system reviewers should register in advance before performing a system review.

Most systematic reviews only included randomized controlled trials and used the cochrane risk bias tool for bias assessment,with a small number of unreported tools for bias assessment.A small number of systematic reviews included cohort studies and case series observations,but no corresponding scales were used for bias assessment,which may affect the authenticity and reliability of the results due to the low quality of the included studies.Based onAMSTAR2 users guide,The author of the system review should also report whether other types of analysis have been carried out during the meta-analysis,so as not to cause selective reporting results and affect reliability.The authors should also report on the source of funding for the included study,and if it is corporate funding,there may be an interest relationship that affects the reliability of the results.

In the systematic review,at least two databases should be searched,and one of the included studies only searched one database,which had great methodological problems.Most studies do not provide search strategies,and detailed search strategies are conducive to the repeated implementation of the study.Most reviews processed the study selection and data extraction in duplicate, to decide by discussion and introduction of a third author while the remaining two did not mention this in the article.A few studies assessed publication bias,but did not elaborate on the causes of publication bias.PRISMA guideline is mainly responsible for reporting quality assessment.Most literature reports are of poor quality,Common items with low scores included structured summary,protocol and registration,search strategy,and funding information.It is hoped that in the future systematic reviewers can learn PRISMA and AMSTAR2 in advance when conducting systematic reviewings,which can reduce many methodological and reporting errors and improve the quality of research.

### 4.3. Strengths

Firstly,it is the latest overview on Different interventions for the treatment of tennis elbow,which can provide new evidence reference for clinical practice.Based on the current results and conclusion of high quality SR,the overview suggested that there are many clinical measures to treat tennis elbow,including acupuncture therapy,drug injection,surgical therapy,physical therapy,etc.,all of which can relieve pain to different degrees.However,acupuncture treatment of tennis elbow has good effect,less side effects and stable long-term effect.Although drug injection has a good short-term effect,it is easy to relapse and has a long course of treatment.Physical therapy has the advantages of good curative effect,low cost and few complications.Although the effect of surgical treatment is relatively fast,it is prone to complications,which could be useful for decision-making for tennis elbow treatment in clinic.Secondly,AMSTAR2 and PRISMA,the latest methodological quality assessment tools,are combined to provide a new direction for how to evaluate and improve the quality of systematic reviews.

### 4.4. Limitations

This overview has several potential limitations.First,The types of studies included in this review include not only RCT,but also cohort studies and case series observations,and the risk bias assessment tools used by some systematic reviewers were inappropriate.Second, there are too many types of interventions, only descriptive analysis was performed, and no comprehensive quantitative analysis was performed.Third,The quality of the research methodology included is not high and the quality of the evidence of the results is not satisfactory.Fourth,Most research and research processes were incompletely reported,the quality of reports was low,and few documents were implemented in accordance with PRISMA's reporting specifications.Finally,There are too many interventions and relatively few literatures comparing different types of interventions, so it is necessary to further study the comparison between different types of interventions.

### 4.5. Opportunities for Future Research

By analyzing and pointing out these insufficiencies in these published systematic reviews,We found that the most common problems were that no trial registration was conducted,no plan was written in advance,no inclusion exclusion list was provided,and no funding source for the included study was reported.Bias and publication bias may be selected during the trial,resulting in poor study quality.It is proposed that the study should be implemented in strict accordance with AMSTAR2 and PRISMA in the future.

### 4.6. Conclusion

In recent years,there have been more and more treatments for the treatment of tennis elbow,but most of them are of low quality and cannot provide valid evidence.Because there are too many research methods,there are not many related studies on the comparison between different types,and it is impossible to draw conclusions on which treatment measures are more effective,but they can alleviate pain,restore elbow joint function and improve quality of life to varying degrees.

### Abbreviations:

AMSTAR-2 = Assessment of Multiple Systematic Reviews-2, RCTs = randomized controlled trials, PRISMA = Preferred Reporting Items for Systematic Reviews and Meta-Analyses, SR = systematic reviews, SP = Substance P,CNKI=China National Knowledge Infrastructure, WF=WangFang Database, VIP=Chinese Scientific Journal Database, CBM=Chinese Biomedical Literatures Database, NRSI=Non-randomised studies of the effects of interventions, VAS=visual analogue scale, DASH=Disabilities of the Arm Shoulder and Hand scores.

### Declarations

Competing interests:

There are no conflicts of interest.

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## Tables



Table 2 Basic characteristics of the included study							
Author	Year	Literature evaluation tool	Research Type	Sample size	Interventions	Control measures	Type of included study
Hu Qiulan[19]	2018	ROB Tool	meta-analysis	6(516)	Fire needles,fire needles and other treatments	Other acupuncture or other treatments	RCT
Hu Lan[20]	2018	ROB Tool	meta-analysis	13(639)	warming needle moxibustion	Conventional acupuncture	RCT
Yu Rui[21]	2018	ROB Tool	meta-analysis	10(934)	Akupotomy therapy	Local closed	RCT/CT
Zhang Xiao[22]	2018	GRADE profiler	meta-analysis	17(1251)	Floating needles or floating needles in combination with other therapies	Use other treatments than floating needles	RCT
Zhong ZongYe[23]	2018	ROB Tool	meta-analysis	10(928)	shock wave	Placebo or other treatment	RCT
Gong Dong [24]	2018	ROB Tool	meta-analysis	10(661)	Platelet rich plasma	glucocorticoid	RCT
Lin Qiang[25-26]	2017	ROB Tool/Jadad	meta-analysis	7(413)	massage	Drugs,acupuncture and moxibustion,cupping,physical therapy,closure and other non-surgical therapy and the above comprehensive treatment	RCT
Ma YanHui[27]	2017	ROB Tool	meta-analysis	21(1570)	Improvement of acupuncture	Conventional acupuncture	RCT
Chen Yan[28]	2016	ROB Tool	meta-analysis	13(980)	Needle knife therapy	Other treatments	RCT
Wang Shuai[29]	2016	Jadad	meta-analysis	5(389)	Extracorporeal shock wave	placebo	RCT
Hao ZhengAn[30-31]	2016	ROB Tool	meta-analysis	11(708)	ESWT+ other treatments	Other treatments	RCT
Sims,S.E.G. [32]	2014	NP	systematic review	58NP	Non-surgical treatment	NP	RCT
Han YanHong[33]	2017	ROB Tool	meta-analysis	10 1280	Small needle knife with partial closure	Small needle knife or partial closure	RCT
Lin,Y.C.[34]	2018	ROB Tool	meta-analysis	6 321	botulinum toxin injection	placebo injections (normal saline) or other regimens	RCT
Pierce,T.P. [35]	2017	NP	systematic review	30 1604	Open Versus Arthroscopic Versus Percutaneous Release of the Common Extensor Origin	NP	NRSI
Mi,B.[36]	2017	Jadad/ROB Tool	meta-analysis	8 511	Platelet rich plasma	steroid	RCT
Mattie,R.[37]	2017	ROB Tool	systematic review	NP	Percutaneous Needle Tenotomy	any other treatment or no treatment	RCT/CT.
Sirico,F.[38]	2017	ROB Tool	meta-analysis	4 218	Local corticosteroid injects	autologous blood injections	RCT
Qian,X.[39]	2016	ROB Tool	meta-analysis	10 509	Autologous Blood Products	Corticosteroid Injections	RCT or prospecti cohort st
Chou,L.C.[40]	2016	Jadad	meta-analysis	9 489	Autologous blood injection	Other types of therapy	RCT
Sayegh,E.T. [41]	2015	ROB Tool	meta-analysis	22(2280)	Nonsurgical Treatment	observation only or placebo	RCT

de Vos,R.J.[42]	2014	PEDro	systematic review	6(NP)	platelet-rich plasma injections	NP	RCT
Kalichman,L.[43]	2011	ROB Tool	Systematic Review and Meta-Analysis	10(273)	botulinum toxin injections	Placebo	RCT
Chang,W.D.[44]	2010	PEDro	systematic review	10(No)	Low-level laser therapy (LLLT)	non-laser or placebo laser	RCT
Gao,B.[45]	2019	ROB Tool	Systematic Review and Meta-Analysis	10(283)	Saline Injections	platelet-rich plasma,autologous conditioned plasma,corticosteroid,and botulinum toxin injections	RCT
Xiong,Y.[46]	2019	ROB Tool/Jadad	meta-analysis	4(237)	Shock-wave therapy	corticosteroid injection	RCT
Weber,C.[47]	2015	SIGN Checklist	systematic review and meta-analysis	16(NP)	physical therapy	usual control group or sham-control group	RCT
Tang,H.[48]	2015	ROB Tool	meta-analysis	4(309)	acupuncture,electroacupuncture,warm acupuncture,needle acupuncture,and manual acupuncture.	sham acupuncture,placebo control,no treatment/waiting list control,or active treatment	RCT
Chang,W.D.[49]	2014	PEDro	meta-analysis	9(527)	manual acupuncture or laser acupuncture treatment	sham procedure or treatment using a placebo laser and needle acupuncture.	RCT
Cullinane,F.L.[50]	2014	Modified Cochrane Musculoskeletal Injuries Group score	systematic review	12(616)	eccentric exercise or in conjunction with other treatments	Nondrug therapy	RCT
Olaussen,M.[51]	2013	PEDro	meta-analysis	11(1161)	corticosteroid injections or non-electrotherapeutical physiotherapy	no treatment	RCT
Raman,J.[52]	2012	the critical appraisal form developed by Dr.Joy C Macdermid (Appendix A)	systematic review	12(NP)	Different Methods of Resistance Exercises	NP	RCT( NRS cohort st
Riff,A.J.[53]	2018	NP	systematic review	35(1640)	Open vs Percutaneous vs Arthroscopic Surgical	NP	Case series/co studies
Burn,M.B.[54]	2017	Jadad /CONSORT/ Cochrane Bone,Joint and Muscle Trauma Group Quality Assessment Tool	systematic review	6(179)	Open,Arthroscopic,and Percutaneous Surgical	NP	RCT( prospecti cohort
Moradi,A.[55]	2019	NOS( Jadad	systematic review	34(1508)	Arthroscopic Surgery	Open Surgery	Case series/co studies

Table 3 Methodological quality of the included reviews assessed by AMSTAR2																	
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	Ranking of quality
Hu Qiulan[19]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	Y	N	PY	Y	low
Hu Lan[20]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	N	N	PY	N	low
Yu Rui[21]	Y	N	N	PY	Y	Y	N	PY	PY	N	PY	N	N	N	N	Y	low
Zhang Xiao[22]	Y	N	N	PY	Y	Y	N	PY	PY	N	Y	N	N	Y	PY	Y	low
Zhong ZongYe[23]	Y	N	N	PY	Y	Y	N	PY	Y	Y	PY	N	Y	N	PY	N	low
Gong Dong[24]	Y	N	N	PY	Y	Y	N	Y	Y	N	PY	N	N	Y	N	Y	low
Lin Qiang[25-26]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	Y	N	PY	N	low
Ma YanHui[27]	Y	N	N	PY	Y	Y	N	PY	Y	N	Y	N	N	Y	PY	Y	low
Chen Yan[28]	Y	N	N	PY	Y	Y	N	PY	Y	N	Y	N	Y	Y	PY	N	low
Wang Shuai[29]	Y	N	N	PY	Y	N	N	PY	PY	N	PY	Y	N	N	N	Y	low
Hao ZhengAn[30-31]	Y	N	N	PY	Y	Y	N	PY	Y	N	Y	N	Y	N	N	N	low
Sims,S.E.G.[32]	N	N	N	PY	Y	Y	N	PY	PY	Y	NP	NP	N	N	NP	Y	low
Han YanHong[33]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	Y	N	PY	Y	low
Lin,Y.C.[34]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	Y	N	N	Y	low
Pierce,T.P.[35]	Y	N	N	PY	Y	Y	N	PY	N	N	NP	NP	N	Y	NP	Y	low
Mi,B.[36]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	N	Y	Y	N	Y	low
Mattie,R.[37]	Y	N	N	PY	Y	Y	N	PY	Y	N	NP	NP	N	N	NP	N	low
Sirico,F.[38]	Y	N	Y	PY	Y	Y	N	PY	Y	N	Y	N	Y	Y	N	N	low
Qian,X.[39]	Y	N	N	PY	Y	Y	N	Y	Y	N	Y	N	Y	Y	PY	N	low
Chou,L.C.[40]	Y	N	N	PY	Y	Y	N	PY	PY	N	PY	N	Y	N	N	Y	low
Sayegh,E.T.[41]	Y	N	N	PY	N	N	N	PY	N	N	Y	N	N	Y	N	N	low
de Vos,R.J.[42]	Y	N	N	PY	Y	Y	N	PY	PY	N	NP	NP	Y	N	NP	Y	low
Kalichman,L.[43]	N	N	N	PY	Y	Y	N	PY	PY	N	Y	N	Y	Y	N	Y	low
Chang,W.D.[44]	Y	N	Y	PY	N	N	N	PY	PY	N	NP	NP	N	N	NP	Y	low
Gao,B.[45]	Y	N	N	PY	Y	Y	N	PY	Y	N	Y	N	Y	Y	N	Y	low
Xiong,Y.[46]	Y	N	N	PY	Y	Y	N	PY	Y	N	Y	N	Y	Y	N	Y	low
Weber,C.[47]	Y	N	N	PY	Y	Y	N	PY	PY	N	Y	N	Y	Y	N	Y	low
Tang,H.[48]	Y	N	N	Y	Y	Y	N	Y	Y	N	PY	N	Y	N	PY	Y	low
Chang,W.D.[49]	Y	N	N	PY	Y	Y	N	PY	PY	N	PY	N	Y	N	PY	Y	low
Cullinane,F.L.[50]	Y	N	N	PY	Y	Y	N	PY	PY	N	NP	NP	Y	N	NP	Y	low
Olaussen,M.[51]	Y	N	N	PY	Y	Y	N	PY	Y	N	PY	Y	Y	Y	N	Y	low
Raman,J.[52]	Y	N	N	PY	Y	Y	N	PY	Y	N	NP	NP	Y	N	NP	N	low
Riff,A.J.[53]	Y	N	N	N	Y	Y	N	PY	N	N	NP	NP	N	Y	NP	Y	low
Burn,M.B.[54]	Y	PY	N	PY	Y	Y	N	PY	Y	Y	NP	NP	Y	Y	NP	Y	low
Moradi,A.[55]	Y	N	N	PY	Y	Y	N	PY	Y	N	NP	NP	N	Y	NP	Y	low

Table 4 Reporting quality of the included reviews assessed by PRISMA																									
Author	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25
Hu Qiulan[19]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y
Hu Lan[20]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	Y	N	Y	N
Yu Rui[21]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	N
Zhang Xiao[22]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N
Zhong ZongYe[23]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y
Gong Dong[24]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	N	N	N	N
Lin Qiang[25-26]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	Y	N	Y	Y
Ma YanHui[27]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	N	N
Chen Yan[28]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y
Wang Shuai[29]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N	N
Hao ZhengAn[30-31]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	N	Y
Sims,S.E.G.[32]	Y	Y	Y	Y	N	Y	□	N	Y	Y	Y	Y	N	N	N	N	Y	Y	Y	N	N	N	N	Y	N
Han YanHong[33]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	Y
Lin,Y.C.[34]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	N	N	N	Y	Y
Pierce,T.P.[35]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	N	Y	Y
Mi,B.[36]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	N	Y
Mattie,R.[37]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	Y	N	Y	Y	Y	N	N	N	N	Y	Y
Sirico,F.[38]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	N	Y
Qian,X.[39]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
Chou,L.C.[40]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	N	Y
Sayegh,E.T.[41]	Y	Y	Y	Y	N	Y	Y	N	Y	N	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	Y	Y	Y	Y
de Vos,R.J.[42]	Y	Y	Y	Y	N	Y	Y	Y	N	N	Y	N	Y	Y	N	N	Y	Y	N	N	N	N	N	N	Y
Kalichman,L.[43]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	Y	Y	N	N	Y	Y
Chang,W.D.[44]	Y	Y	Y	Y	N	Y	Y	N	N	N	Y	N	Y	Y	N	N	N	Y	N	N	N	N	N	Y	Y
Gao,B.[45]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	N	N	Y	Y
Xiong,Y.[46]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y
Weber,C.[47]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	Y	Y
Tang,H.[48]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y
Chang,W.D.[49]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	N
Cullinane,F.L.[50]	Y	Y	Y	Y	N	Y	Y	Y	Y	Y	Y	Y	N	N	N	N	Y	Y	N	N	N	N	N	Y	N
Olaussen,M.[51]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	Y	Y	N	N	Y	Y
Raman,J.[52]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	Y	Y	Y	N	N	Y	Y	Y	N	N	N	N	Y	Y
Riff,A.J.[53]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	N	N	Y	Y	N	N	Y	N	N	Y	Y	N	N	Y	Y

Burn,M.B. [54]	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	N	N	Y	Y	N	N	N	N	Y	Y
Moradi,A.[55]	Y	Y	Y	Y	N	Y	Y	N	Y	Y	Y	N	Y	Y	N	N	Y	Y	N	N	Y	N	N	Y	Y

## Figures

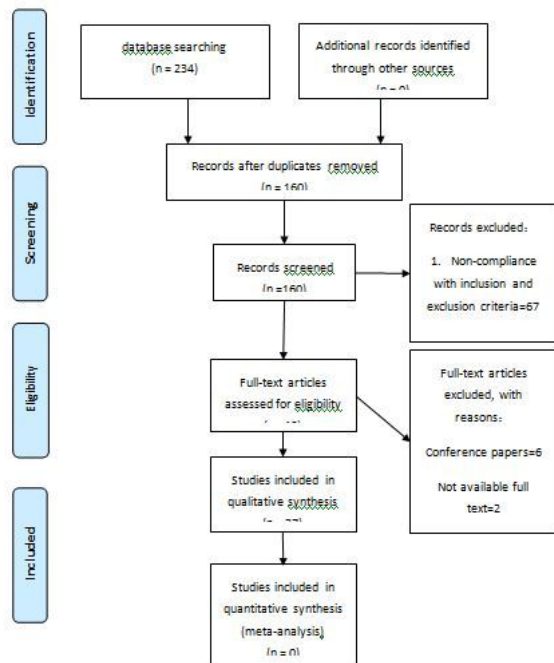


Figure 1

Literature retrieval flow chart