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Does intra-articular injection of PRP help patients with temporomandibular joint osteoarthritis after joint puncture? a systematic review and meta-analysis of randomized controlled trials

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Abstract

Objective The aim of this study is to conduct a systematic review to evaluate whether intra-articular injection of platelet-rich plasma (PRP) after joint puncture can aid in the recovery of patients with temporomandibular joint osteoarthritis (TMJOA).

Methods We searched PubMed, Cochrane Library, Embase and Web of Science as of March 3, 2024. Retrieved a total of 392 articles. We included all published randomized controlled trials (RCTs). All RCTs, including studies on PRP injection after joint puncture in patients with TMJOA. The primary outcome was pain reduction, and the secondary outcome was the improvement of maximal mouth opening (MMO) and joint sounds. All outcome measures were analyzed by calculating the standardized mean differences (SMDs) and 95% confidence intervals (CIs).

Results A total of 392 articles were retrieved, and ultimately, 6 articles met the inclusion criteria. The study involved 199 TMJOA patients. The results indicated that compared to the control group, PRP injection after joint puncture showed significant improvements in alleviating pain (SMD =-0.99; 95% CI =-1.35 ~-0.63; P <0.00001, I^2 = 59%) and MMO (SMD = 0.63; 95% CI = 0.30 ~ 0.95; P <0.0002, I^2 = 54%) among TMJOA patients. However, there was no significant improvement observed in terms of joint sounds (SMD =-0.34; 95% CI = -0.71 ~ 0.02; P = 0.06, I^2 = 0%) with the PRP.

Conclusions Compared to joint puncture alone, the intra-articular injection of PRP after joint puncture was more effective in relieving pain. At 1-month and 6-month follow-ups, patients in the PRP group showed significant improvements in MMO compared to the control group. However, after 12 months of follow-up, limited evidence indicated significant improvements in MMO and joint sounds.

Keywords Platelet-rich plasma, Temporomandibular joint osteoarthritis, Systematic review, Meta-analysis, Randomized controlled trials

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Introduction

The temporomandibular joint (TMJ) is a crucial joint that connects the mandible to the skull. It plays an essential role in facial movements, chewing, speaking, and other functions [1]. Temporomandibular disorder is the second most common musculoskeletal disorder that causes pain and disability [2]. TMJ osteoarthritis (TMJOA) typically presents with symptoms such as joint pain, limited mobility, clicking or popping sounds, and difficulty opening the mouth, which can significantly impact the patient's quality of life [3]. TMJOA is part of the group IIIDC/TMD diagnosis [4, 5]. The causes of TMJOA are multifactorial, with common contributing factors including trauma, wear and tear, occlusion issues, infection, and immune reactions [6]. As the condition progresses, degenerative changes may occur in the joints cartilage and disc, leading to structural damage and functional impairment [7, 8].

Current treatment options for TMJOA are diverse and include pharmacological therapy, physical therapy, joint puncture, and surgical interventions [9]. The primary treatment goal is to alleviate pain, reduce inflammation, restore joint function, and prevent further deterioration [10, 11]. However, existing treatment methods have certain limitations, particularly in addressing joint cartilage damage and inflammatory responses, with results that may not always meet expectations [12–14].

Joint puncture is a common method for treating TMJOA and is typically used to remove fluid from the joint, clear inflammatory mediators, and inject medications [15, 16]. Traditional joint puncture often involves the injection of corticosteroids or anesthetics to relieve symptoms, but this approach is largely symptomatic and does not address the underlying joint damage or degenerative changes [17, 18]. Furthermore, recovery after joint puncture may take time, and complications such as inflammation and swelling can arise [19].

Thus, combining joint puncture with other treatments may further facilitate recovery in TMJOA patients, such as intra-articular injections of hyaluronic acid (HA), corticosteroids (CS), and platelet-rich plasma (PRP) [20, 21]. However, some studies have concluded that adding HA and CS injections after joint puncture does not improve the long-term outcomes for TMJOA patients [22]. Recent research has examined the efficacy of PRP injections after joint puncture, and found that PRP may yield better clinical results than HA [23, 24]. PRP is a component derived from the patient's own blood, rich in platelets, which contain various growth factors and cytokines that promote tissue repair, reduce inflammation, and stimulate cartilage regeneration [25, 26].

In recent years, PRP treatment has demonstrated potential efficacy in various types of arthritis, particularly in the treatment of cartilage damage and joint degeneration, showing promising clinical outcomes [27, 28]. PRP stimulates local repair mechanisms, promotes neovascularization, enhances cell migration, and accelerates tissue regeneration, thus helping to reduce inflammation and restore joint function [29]. Although PRP has shown positive clinical results in other types of arthritis, such as knee and shoulder arthritis, its efficacy in TMJOA remains controversial [30]. Due to the unique structure of the TMJ and the complexity of its clinical manifestations, the effectiveness of PRP treatment for this condition has not been fully validated, and there is a lack of standardized guidelines for its application and indications in TMJOA [31].

Autologous PRP has the lowest risk of immune reactions and infectious disease transmission, and has been widely used in the treatment of TMJOA. In some clinical trials, TMJOA patients have shown some therapeutic effects in reducing joint pain, improving maximum mouth opening, and joint mobility after PRP injections [32]. Currently, clinical studies on PRP injection after joint puncture for TMJOA have used varying outcome measures and sample sizes, and there are few systematic review and meta-analysis have been published.

Therefore, our systematic review and meta-analysis rigorously included studies on TMJOA patients and employed a randomized controlled trial design to investigate the therapeutic effects of PRP injection after joint puncture on this population.

Methods

Protocol and registration

This study was conducted and written according to the PRISMA guidelines [33] for systematic reviews and meta-analyses and has been registered on the PROSPERO platform with the registration number CRD42024527458. The data used in this study were all extracted from publicly available published RCTs and did not involve direct recruitment of patients; therefore, no ethical or moral approval was required for this study.

Search strategy

Two investigators (Xu and Wu) independently searched PubMed, Embase, the Cochrane Library and Web of Science from inception to March 01, 2024, without language or regional restrictions. In the research process, we used Cohen's Kappa to assess the consistency between-researchers. The search terms included the subject headings "platelet-rich plasma" and "temporomandibular joint osteoarthrosis," as well as related free-text keywords. References in relevant studies were manually searched to ensure comprehensive inclusion. The search strategies and process of inclusion were displayed in S1 File. Please refer to S2 File for the search formula and search history.

Study selection

EndNote (version X9, Clarivate Analytics) was used to filter the searched articles. After eliminating duplicate entries, two researchers (Xu and Wu) assessed the reports according to specific criteria for inclusion and exclusion. Initially, they reviewed the titles and abstracts, and subsequently examined the full texts independently, excluding any studies deemed irrelevant. In case of any discrepancies in the final results, The reviewer (Zhang) conducted an initial screening, and after discussions among the three authors, a final decision was made regarding the studies to be included.

The inclusion criteria for this study were as follows: (1) Only patients with TMJOA were included, diagnosis is performed according to the clinical diagnostic criteria defined by the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD) guidelines and CBCT evaluations; (2) Intervention: Intra-articular injections of PRP, with joint puncture in patients diagnosed with TMJOA; (3) Comparator: Patients receiving joint puncture alone, including lysis and lavage using normal saline or Ringer's solution with injection of medications (placebo group); (4) Outcomes: primary outcome: pain, and secondary outcome: maximum mouth opening (MMO) and joint sounds; (5) Study design: the study design had to be a randomized controlled trial (RCT).

Exclusion criteria: (1) Studies lacking complete data; (2) Review articles and animal studies; (3) Studies with participants who received alternative treatments that could impact the results; (4) Studies published in languages other than English.

Data extraction and management

The literature included in the analysis provided data on author and publication year, trial country, patient age, intervention methods for both intervention and control groups, intervention period and frequency, the dose of PRP injection, and outcome measures. The data were independently extracted and tabulated by two researchers (Xu and Wu), followed by a comparison and verification by a third author (Zhang). In case of any discrepancies, the original text was taken as the reference. The final version of the table was determined through discussion and consensus among all three researchers.

Quality assessment

The risk of bias was assessed using Review Manager (RevMan) [Computer program]. Version 5.4, The Cochrane Collaboration, 2020 [34]. Two authors (Xu and Wu) independently read the full texts and conducted an objective evaluation of the risk of bias in the studies included in this review. The assessment covered the following domains: selection bias (random sequence generation, allocation concealment), performance bias (blinding of participants and personnel), detection bias (blinding of outcome assessment), attrition bias (incomplete outcome data), and reporting bias (selective reporting). Each domain was evaluated and classified into three categories: (1) low risk of bias, (2) high risk of bias, and (3) unclear risk. After the assessment was completed, a third author (Zhang) conducted a verification check.

Data analysis

As for outcomes measurements (VAS scores, MMO scores) in each study, the mean difference between the baseline and post intervention was calculated to compare the efficacy of intervention with the control group. The present study was conducted by using meta-analysis software Review Manager 5.4 from the Cochrane Collaboration. The standard mean difference (SMD) and 95% confidence interval (CI) were calculated for continuous outcomes (VAS scores, MMO scores), while risk ratios (RRs) with 95% CIs were adopted for dichotomous outcome (adverse events). Heterogeneity between groups was tested by the Cochran's Q statistics and I^2 test. If there was no heterogeneity between the groups (Q test shows $P > 0.05$ or $I^2 < 50\%$), a fixed-effect model would be applied. Otherwise, if the Q test results were significant ($P < 0.05$ or $I^2 > 50\%$), a random-effect model would be used in the meta-analysis. When I^2 is greater than 50%, sensitivity analysis or subgroup analysis is conducted to explore the sources of heterogeneity. $P < 0.05$ was considered to be of statistical significance.

Results

Search results

A total of 392 relevant records were retrieved from four commonly used medical databases (PubMed = 102, Cochrane = 53, Web of Science = 119, Embase = 118). The process of literature search and screening is depicted in Fig. 1. All titles and abstracts were imported into EndNote for preliminary screening and analysis. The duplicate records feature in EndNote was used to remove 224 duplicate entries, leaving 168 records. After screening titles and abstracts, 70 review articles or conference abstracts, 15 articles with incompatible study designs, and 58 articles unrelated to TMJOA were excluded. The full texts of 25 articles were carefully reviewed. Six articles were excluded for not meeting the study criteria, nine were excluded due to lack of randomization, and 4 articles were excluded because of incomplete data. Ultimately, 6 studies that met the inclusion criteria were selected for inclusion.

Study characteristics

Table 1 shows the baseline characteristics of patients included in the 6 randomized controlled trials. These studies were published between 2015 and 2023 and

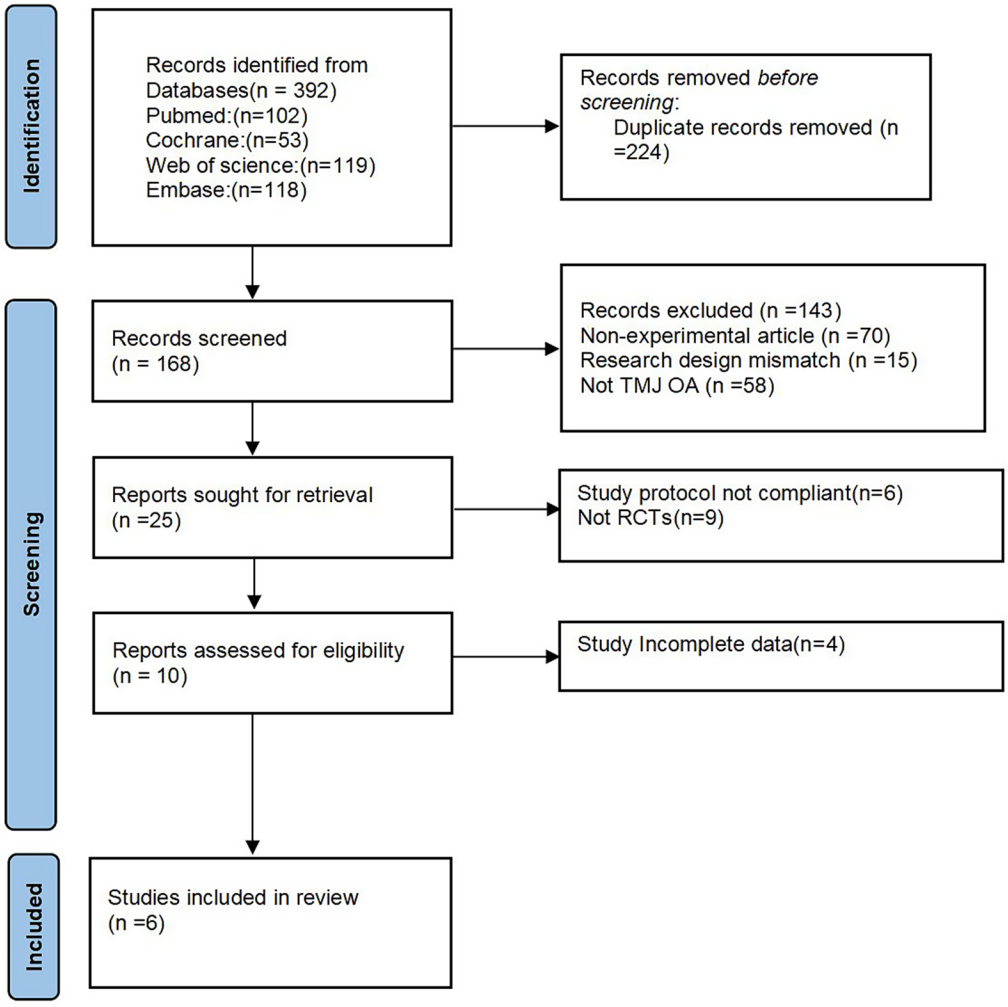

Fig. 1 Flow diagram of included studies

included a total of 199 TMJOA patients. All 6 studies were published in English, with 2 conducted in Turkey [23, 35], 2 in the Egypt [22, 36], and 1 each SYR [37], and Iran [38]. In 6 studies [22, 23, 35–38], the intervention group received PRP in combination with other treatments. Four included studies compared PRP with HA injections [22, 35, 36, 38], two RCTs compared PRP to no injection [23, 37]. All studies assessed pain and MMO as an outcome measure, while three studies assessed joint sounds [23, 35, 36]. As to the treatment options, five studies injected 1 ml PRP each time, and one study injected a combination of 1mlPRP and 1mlHA [36]. Regarding the number of injections, the two included RCTS were four injections of PRP [23, 35], one was three injections [22], and the rest were one injection. Although different assessment scales were used across these studies, the data related to the same outcome measures were analyzed together.

Quality assessment

The results of the risk of bias assessment for the six studies are shown in Figs. 2 and 3. Only RCTs were included, so all six studies (100%) implemented randomization. Three studies provided a detailed description of the allocation concealment process, while the other three did not mention whether allocation concealment was used. All studies employed blinding (100%). Two studies employed blinding for outcome assessors and data analysts [36, 37]. Two studies did not indicate whether outcome evaluators and data analysts were blinded [22, 23], and two studies did not blind outcome evaluators and data analysts [35, 38]. All included studies had complete data (100%). The risk of selection bias was considered unclear for all trials (100%). Due to the small number of studies included in this review, we did not conduct an analysis of publication bias.

Table 1 Basic characteristics of included citations

Author, year	Country	E/C(*N*)	Age(year) (M ± SD)	Experimental group	Control group	Treatment options	Outcome
Kiliç,2015	Turkey	18/12	E:32.22 ± 14.33 C:35.08 ± 14.84	Arthrocentesis + PRP	Arthrocentesis	PRP: 1 ml Participants initially received arthrocentesis plus PRP injection and then four consecutive PRP injections into the TMJ following intra-articular anesthesia monthly.	VAS, MMO, Joint sound
Hegab,2015	Egypt	18/18	E:39 ± 4.975 C:38.2 ± 4.368	Arthrocentesis + PRP	Arthrocentesis + HA	PRP:1 ml Once per week for 3 consecutive weeks. HA:1 ml Once per week for 3 consecutive weeks.	VAS, MVMO, Joint sounds
Kiliç,2016	Turkey	18/13	E:32.22 ± 14.33 C:28.08 ± 11.12	Arthrocentesis + PRP	Arthrocentesis + HA	PRP:1 ml Four consecutive PRP injections. HA:1 ml One injection in total.	VAS, MMO, Joint sounds
Abbadi,2022	SYR	11/11	E:28.73 ± 7.73 C:27.09 ± 7.38	Arthrocentesis + PRP	Arthrocentesis	PRP:1 ml One injection in total.	VAS, MMO, Joint sounds
Asadpour,2022	Iran	10/10	E:29.5 ± 8.9 C:29.5 ± 8.5	Arthrocentesis + PRP + HA	Arthrocentesis + HA	PRP:1 ml One injection in total. HA:1 ml One injection in total.	VAS, MMO
Hegab,2023	Egypt	30/30	E:59.56 ± 8.18 C:59.42 ± 10.66	Arthrocentesis + PRP + HA	Arthrocentesis + HA	PRP:1 ml a mixture of 1 ml HA and 1 ml of PRP was injected into the TMJ. One injection in total. HA:2 ml One injection in total.	VAS, MVMO, Joint sounds

E = Experimental group; C = Control group; PRP = platelet-rich plasma; HA = hyaluronic acid; VAS = visual analog scale; MMO = maximum mouth opening; SYR = Syria

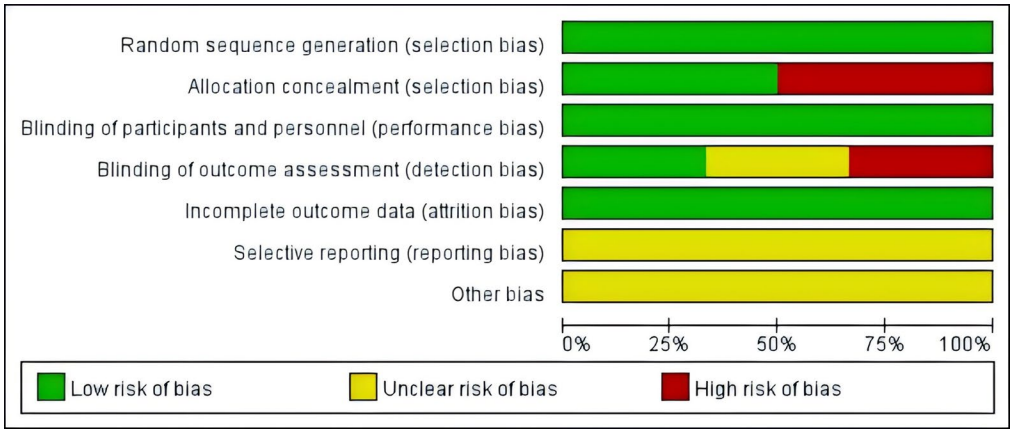

Fig. 2 Risk of bias graph

Analysis of pain

All of the studies included in the analysis reported pain-related outcomes, with a total of 199 participants, as illustrated in Fig. 4. The analysis results indicated that compared to the control group, PRP injection can effectively alleviate pain in TMJOA patients (SMD =-0.99; 95% CI =-1.35 ~-0.63; P <0.00001, I^2 = 59%). Due to the high heterogeneity in the results, we conducted subgroup analyses based on different follow-up times to explore the sources of heterogeneity.

This analysis will divide the study into three subgroups, with follow-up times at 1-month [36–38], 6-months [36–38], and 12-months [22, 23, 35, 36]. Subgroup analysis showed that in three studies of pain follow-up for one month, compared with the control group, PRP significantly reduced pain in patients with TMJOA (SMD =-1.13; 95% CI = -1.55 ~ – 0.70; P <0.00001, I^2 = 0%). In three studies with a 6-months follow-up on pain, compared to the control group, PRP showed a significant analgesic effect on TMJOA pain, with lower heterogeneity(SMD =-0.93; 95% CI = -1.39 ~ – 0.48;

Fig. 3 Risk of bias summary

P <0.0001, I^2 = 11%). However, in four studies with a 12-month follow-up on pain, compared to the control group, although PRP had a significant analgesic effect on TMJOA patients, there was high heterogeneity (SMD =-0.91; 95% CI = -1.77 ~ – 0.04; P = 0.04, I^2 = 84%).In addition, subgroup analysis results showed that there was no significant difference in the analgesic effect of PRP on TMJOA at different follow-up times (1-month, 6-months, or 12-months) (P = 0.80).

After excluding the study that prepared PRP using a lower centrifugation speed (1000 rpm) [23, 35], we found that PRP injection after joint puncture can still relieve pain in TMJOA patients, but heterogeneity decreased (SMD =-1.20; 95% CI = -1.50 ~ -0.90; P <0.00001, I^2 = 27%), as shown in Fig A in S3 File.

Analysis of MMO

All of the studies reported changes in MMO after PRP treatment in 199 patients with TMJOA, as shown in Fig. 5. Compared to the control group, PRP effectively increase the MMO of patients with TMJOA (SMD = 0.63; 95% CI = 0.30 ~ 0.95; P <0.0002, I^2 = 54%).

Similarly, we conducted subgroup analysis based on the follow-up time of MMO in the included studies. This analysis will categorize the study into three subgroups based on follow-up times at 1-month [36–38], 6-months [36–38], and 12-months [22, 23, 35, 36]. Subgroup analysis revealed that in three studies assessing MMO 1-month post-treatment, PRP demonstrated a significant increase in MMO among patients with TMJOA compared to the control group, albeit with high heterogeneity (SMD = 0.92; 95% CI = 0.06 ~ 1.78; P = 0.04, I^2 = 70%). Among patients with TMJOA in three studies evaluating MMO 6-months after treatment, PRP led to a significant improvement in MMO compared to the control group.

Furthermore, heterogeneity also decreased (SMD = 0.76; 95% CI = 0.14 ~ 1.38; P = 0.02, I^2 = 49%). However, in four studies with a 12-months follow-up on MMO, there was no significant increase the range of mouth opening of PRP on TMJOA compared to the control group, and the heterogeneity was high (SMD = 0.40; 95% CI = -0.14 ~ 0.94; P = 0.15, I^2 = 63%).Furthermore, the results of subgroup analysis indicated that the MMO effect of PRP on TMJOA did not vary significantly across different follow-up periods (1-month, 6-months, or 12-months) (P = 0.52).We found that one study [36] included older patients for PRP injection. After excluding this study, the results remained unchanged, but heterogeneity significantly decreased (SMD = 0.55; 95% CI = 0.21 ~ 0.89; P = 0.001, I^2 = 48%), as shown in Fig B in S3 File.

Analysis of joint sounds

Three studies [23, 35, 36] evaluated the joint sounds in 121 patients, as shown in Fig. 6. The analysis results showed that there was no statistically significant difference in the change in joint sounds between the PRP treatment group and the control group (SMD =-0.34; 95% CI = -0.71 ~ 0.02; P = 0.06, I^2 = 0%). After excluding a study [23] that prepared PRP using a lower centrifugation speed (1000 RPM), the PRP group showed significant improvement in the joint sounds of patients with TMJOA patients compared to the control group (SMD =-0.45; 95% CI = -0.87 ~ 0.03; P = 0.04, I^2 = 0%), as shown in Fig C in S3 File.

Discussion

This meta-analysis included six randomized controlled trials examining the effects of PRP injection following joint puncture on pain, MMO, and joint sounds in patients with TMJOA. Additionally, subgroup analyses were conducted on the primary outcome measures of pain and MMO. Our findings indicate that PRP injection

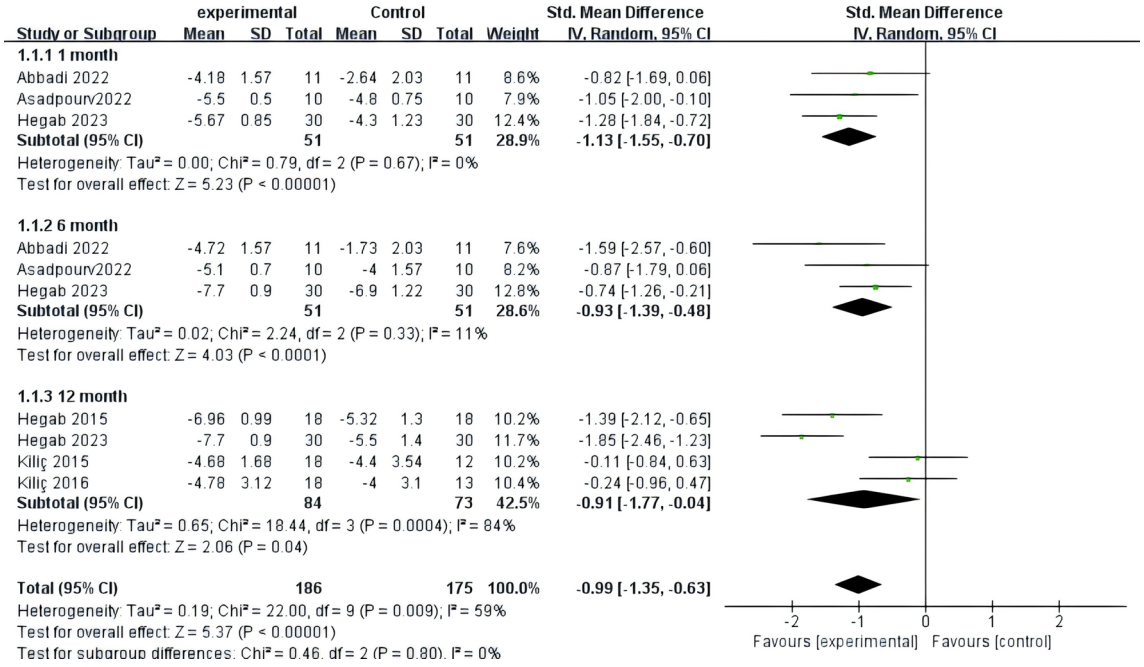

Fig. 4 Subgroup analysis for the VAS scores

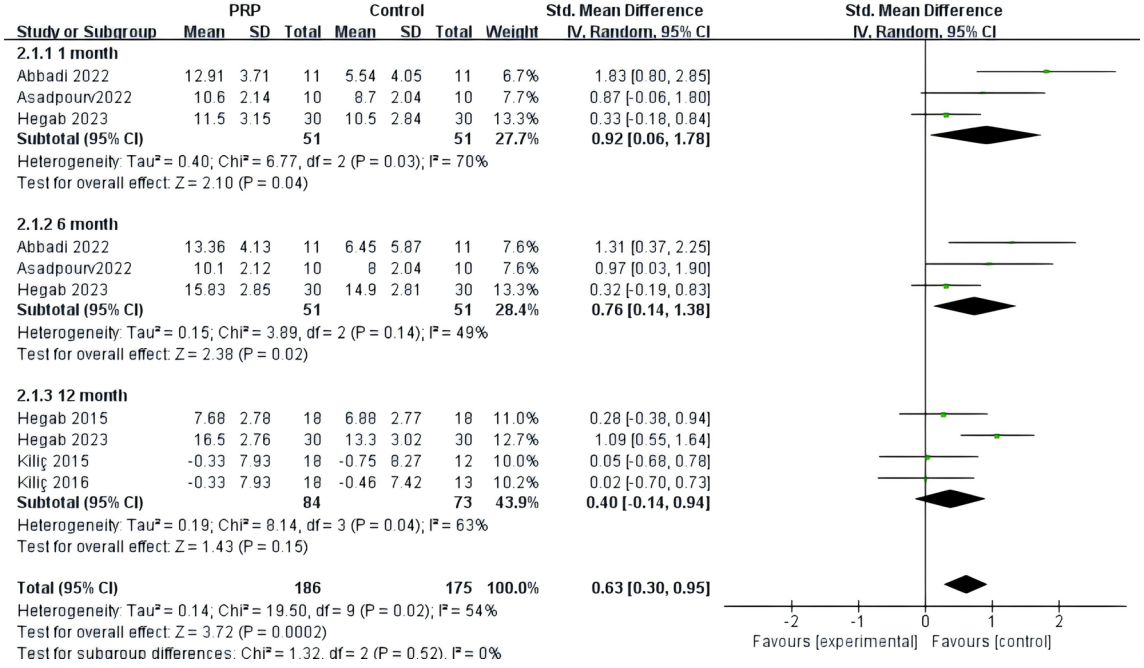

Fig. 5 Subgroup analysis for the MMO

after joint puncture effectively alleviates pain in TMJOA patients both in the short term and long term, consistent with previous meta-analyses on PRP treatment for osteoarthritis(OA) [39, 40]. Additionally, PRP injection after joint puncture shows some improvement in MMO for TMJOA patients, but no significant difference was observed at the 12-month follow-up. In the long term, PRP injection after joint puncture does not effectively improve MMO. Our study reveals differences in the effect of PRP injection on joint sounds in TMJOA patients compared to previous research, which has demonstrated that intra-articular injection can effectively improve joint sounds in these patients [18, 26, 41]. However, the results of this study indicate that PRP injection

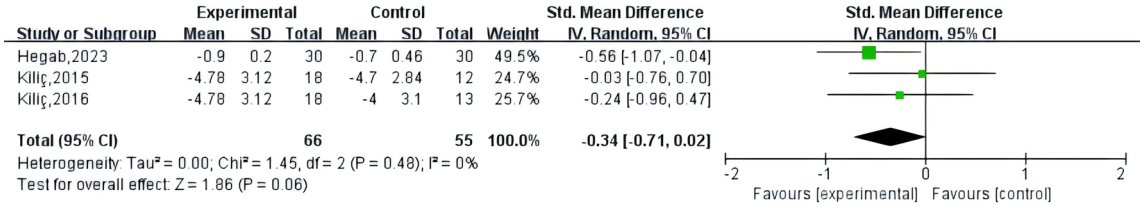

Fig. 6 Forest plot for the joint sounds

after joint puncture does not effectively reduce joint sounds in TMJOA patients.

4.1 The effect of PRP injection after joint puncture on pain

Based on our analysis, we found that PRP injections after joint puncture can significantly reduce pain perception in patients. Due to high heterogeneity, we performed subgroup and sensitivity analyses. After excluding two studies that prepared PRP using a lower centrifugation speed (1000 RPM), heterogeneity significantly decreased. Therefore, we speculate that different PRP preparation methods and technical parameters affect the efficacy in relieving pain in TMJOA patients, with PRP prepared at higher centrifugation speeds potentially being more beneficial for alleviating pain in TMJOA patients. The PRP obtained from different centrifugation methods also varies in its content of various factors. Previous studies have indicated that PRP prepared at higher centrifugation speeds tends to have higher concentrations of growth factors [42]. It is worth noting that although both PRP and PRF (Platelet-Rich Fibrin) are biological products extracted from the patient's own blood, there are differences between the two. PRP preparation requires the use of an anticoagulant, followed by centrifugation to separate platelets and retain growth factors in the plasma. It is mainly used for tissues and wounds that require rapid healing [43]. In contrast, PRF preparation does not involve anticoagulants and is produced using a lower centrifugation speed, which retains more fibrin. PRF is primarily used to promote long-term tissue repair and regeneration [44]. In summary, the differences in PRP preparation methods and their bioactive components may have varying effects on pain relief and treatment outcomes for TMJOA patients.

Recently, PRP has been recognized as a beneficial orthobiological treatment. It helps replenish hyaluronic acid within the joints, boosts glycosaminoglycan chondrocyte production, regulates joint blood vessel growth, and supports the migration of stem cells by providing a scaffold [45]. Previous studies have observed the pain-reducing effects of PRP, and multiple authors have reported the analgesic properties of platelets [46, 47]. TMJOA pain is mainly caused by inflammation. Inflammatory factors (such as interleukin-1β, interleukin-6, and tumor necrosis factor-α) are released after inflammation occurs in the temporomandibular joint, which decrease the nociceptor threshold and play an important role in the occurrence of pain [48, 49]. PRP works by changing the environment of the TMJ through the use of the patient's own blood products, which contain growth factors that can reduce inflammation and stimulate cartilage growth. Additionally, intra-articular injection of PRP can reduce the expression of pain mediators, such as prostaglandin E2, substance P, dopamine, and 5-hydroxytryptamine [50]. Research has shown that PRP can effectively alleviate pain in TMJOA, and it is superior to HA and CS in terms of pain relief, which is consistent with our findings. Additionally, PRP does not cause discomfort such as swelling or soreness, which can occur with CS injections [51, 52].

The effect of PRP injection after joint puncture on MMO

Our meta-analysis evidenced that PRP has a significant effect on improving MMO in patients with TMJOA. In particular, after excluding a study that included older participants, the heterogeneity was significantly reduced. Therefore, we hypothesize that the effectiveness of PRP injection after joint puncture in improving TMJOA may be related to age. Older patients may be less tolerant to PRP injections, and as age increases, the TMJ cartilage gradually degenerates, which may hinder improvements in MMO.

Previous foundational and clinical studies have indicated that PRP therapy effectively treats OA symptoms and repairs cartilage defects [53]. Recent animal experiments have further shown that PRP impacts condylar cartilage thickness by preventing apoptosis in OA chondrocytes [54]. PRP therapy can remove fragments and inflammatory cytokines from the synovial fluid, reduce friction on the joint surface, regulate intra-articular pressure, and aid in the healing process of TMJOA [55, 56]. Iwanaga T et al. [57] injecting a certain amount of PRP into the joint cavity was found to promote synovial cells to secrete endogenous hyaluronic acid and metalloproteinases that are beneficial for joint lubrication.

We conducted a subgroup analysis and found no significant difference in the treatment of TMJOA with PRP injection compared to the control group at the 12-month follow-up. Some scholars studying the role of PRP in OA have found that after PRP injection, sustained long-term

therapeutic effects were not observed, and there was a phenomenon of diminishing therapeutic efficacy over time [58]. PRP is prepared by drawing blood, spinning it in a centrifuge to separate the plasma, and then concentrating the platelets for injection. After centrifuging the PRP preparation, the concentration of platelets and growth factors can be increased. Some cytokines released by PRP, such as VEGF. According to relevant research [59], VEGF stimulates chondrocytes to secrete matrix metalloproteinases (MMPs) through its signaling pathways, while simultaneously inhibiting their secretion. This biological effect leads to damage to the extracellular matrix of chondrocytes, thereby disrupting cartilage. Previous research suggested that PRP therapy has promising long-term efficacy in the treatment of knee osteoarthritis (KOA) [60]. However, there are notable differences between TMJ cartilage and knee cartilage [61]. Knees have more synovial tissue compared to TMJ, which contains targets for PRP therapy [62, 63]. The presence of synovial tissue in knees, which TMJ lacks, may potentially explain why PRP therapy does not show long-term efficacy in TMJOA.

The effect of PRP injection after joint puncture on joint sounds

The analysis results indicate that PRP injections after joint puncture have no significant effect on the sounds in TMJOA patients. Since PRP injections after joint puncture do not significantly improve joint sounds in TMJOA patients, we conducted a sensitivity analysis and found that excluding a study that prepared PRP using a lower centrifugation speed (1000 RPM), PRP showed a significant improvement in joint sounds for patients with TMJOA. Therefore, we infer that different PRP preparation methods and technical parameters yield varying efficacies in treating joint sounds in TMJOA patients, with PRP prepared at higher centrifugation speeds potentially more beneficial for improving joint sounds in TMJOA patients.

After carefully comparing the included literature and reviewing relevant studies, the following reasons may contribute to these findings. Firstly, the studies included had a wide range of participant ages, which might affect the efficacy of PRP injections. According to reports, aging is an important factor in the pathological process of OA [64]. Furthermore, as hyaluronic acid degrades and free radical activity increases, joint hydration decreases, resulting in increased friction between the joint surfaces. This increased friction during temporomandibular joint movement can cause irreversible damage to joint structures, internal derangements of the articular disc, degenerative changes and the clicking sound increases during vertical and lateral movements of the mandible [13, 65]. It is possible that older age may not cause significant changes in joint sounds in patients, thus failing to capture the potential benefits of PRP for TMJOA patients. Additionally, the included studies may have used different measurement tools to assess joint sounds, which could result in differences in the outcomes. This variability is difficult to avoid, as there is still no standardized measurement tool for assessing joint sounds in TMJOA patients to ensure complete consistency of results [66].

Limitations

There are a few limitations in this review. Firstly, to increase the sample size for analysis, combination therapy were included. It remains uncertain whether PRP has a synergistic effect with other treatments. Secondly, there was diversity in the duration of treatment and follow-up. Lastly, In the randomized controlled trials included, there were variations in the preparation methods and number of PRP injections, which could introduce bias. Therefore, more well-designed randomized controlled trials with longer follow-up periods are still needed.

Conclusions

After approximately 1, 6, and 12-months of PRP injection after joint puncture in TMJOA patients, pain showed significant improvement. After about 1 and 6-months of PRP injection after joint puncture in patients with TMJOA, there was significant improvement in MMO. However, in terms of long-term treatment effects (12-months), MMO and joint sounds did not significantly differ from the control group. Based on current evidence, intra-articular PRP injection after joint puncture demonstrates a promising therapeutic effect for TMJOA, effectively relieving pain and temporarily increasing maximum mouth opening. It is worth considering for clinical application in TMJOA patients. However, there is no significant long-term effect on MMO and joint sounds, indicating the need for additional PRP injections after 12 months. Furthermore, combining other therapeutic approaches, such as medication and physical therapy, may have a more pronounced effect on MMO and joint sounds.Nevertheless, further analysis with larger sample sizes is needed to evaluate its impact on patients' maximum mouth opening and joint sounds.

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12903-025-05826-5.

Supplementary Material 1

Supplementary Material 2

Supplementary Material 3

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Author contributions
FW and FX proposed the original idea and design of this study. ZJ and WL provided valuable suggestions for the completion of the manuscript. FW and FX wrote the manuscript. XY, YT, and KJ perform initial search, filtering, and data analysis. FX and FW completed data extraction and charting. All authors contributed to the article and approved the submission of the final version.

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Data availability
Data is provided within the manuscript or supplementary information files.

Declarations

Ethics approval and consent to participate
NA.

Consent for publication
All authors agree to this submission and final publication.

Competing interests
The authors declare no competing interests.

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