Lavage Therapy Versus Nonsurgical Therapy for the Treatment of Arthralgia of the Temporomandibular Joint: A Systematic Review of Randomized Controlled Trials

Lukas M. Vos, DMD
Research Assistant
Department of Oral and Maxillofacial Surgery
University Medical Center Groningen
University of Groningen
Groningen, The Netherlands

James J.R. Huddleston Slater, DMD, PhD
Senior Researcher
Department of Oral and Maxillofacial Surgery
University Medical Center Groningen
University of Groningen
Groningen, The Netherlands

Boudewijn Stegenga, DMD, PhD
Professor
Department of Oral and Maxillofacial Surgery
University Medical Center Groningen
University of Groningen
Groningen, The Netherlands

Correspondence to:
Dr Lukas M. Vos
Hanzeplein 1
P.O.Box 30 001
9700 RB Groningen
The Netherlands
Fax +31 (0)50 361 11 36
Email: l.m.vos@umcg.nl

Aims: *To carry out a systematic review of randomized controlled trials (RCTs) to investigate in patients with arthralgia of the temporomandibular joint (TMJ) the effectiveness of TMJ lavage compared to nonsurgical treatment with regard to pain intensity and mandibular range of motion.* ***Methods:*** *The electronic databases Cochrane Controlled Trials Register (1960–2012), PubMed/Medline (1966–2012), and Embase (1966–2012) were systematically searched for relevant RCTs. References of relevant articles were searched for additional studies, as well as citing reports. Two authors independently performed data extraction by using predefined quality indicators. Relevant outcome data included reduction in pain, as assessed by a visual analog scale (VAS) or a pain score, and maximal mouth opening (MMO) before and 6 months after treatment. Included trials were combined using fixed and random effects meta-analysis.* ***Results:*** *Three RCTs (222 patients) were included for meta-analysis. The statistically significant overall standardized mean difference (SMD) (*$P < .001$*) with regard to pain intensity was –1.07 (95% CI = –1.38, – 0.76) in favor of TMJ lavage. The MMO did not change significantly (*$P > .05$*, SMD = .05 [95% CI = –0.33, 0.23]).* ***Conclusions:*** *The results suggest that lavage of the TMJ may be slightly more effective than nonsurgical treatment for pain reduction. However, this difference is not likely to be clinically relevant.* J OROFAC PAIN 2013;27:171–179. doi: 10.11607/jop.1007

Key words: arthralgia, arthrocentesis, arthroscopy, meta-analysis, temporomandibular joint

Degenerative diseases of the temporomandibular joint (TMJ) often involve significant pain and reduced range of motion of the mandible. Because of its chronic nature, the disease often has considerable impact on the patient's quality of life.[1,2] In the TMJ, osteoarthritis usually occurs in combination with internal derangements such as disc displacement with or without reduction (closed lock).[3–5] In the case of internal derangements, the intra-articular disc acts as an obstacle for normal movement and results in clicking and locking.[6] Especially in older patients with longer locking duration and less interincisal opening, there is a high incidence of adhesion formation in the upper joint space that reduces the range of motion of the mandible.[7]

Therapeutic modalities for TMJ osteoarthritis can be divided into surgical and nonsurgical therapies. Nonsurgical treatment usually implies explication of the process involved, soft diet, mandible movement exercises, physiotherapy, and possibly splint therapy.[8,9] When nonsurgical treatment is unsuccessful, surgical interventions such as minimally invasive procedures (ie, arthrocentesis or arthroscopy) or open joint procedures may be considered.

In 1975, Ohnishi introduced arthroscopy as a minimally invasive technique that allowed direct visualization of the joint structures and at the same time performance of lysis and lavage of the upper joint space.[10,11] To date, TMJ arthroscopy has been reported to be an effective and reliable technique for the treatment of closed lock.[12] Arthrocentesis of the TMJ is a minimally invasive lavage of the upper joint space and uses two communicating needles that are introduced into the upper compartment of the joint. This procedure has proven to be highly efficient for resolving pain of the TMJ caused by adherence or friction, and it is considered to be successful in approximately 70% of the patients with symptomatic TMJ osteoarthritis.[13,14] In the past decade, arthroscopy and arthrocentesis have been applied with increasing frequency to treat TMJ internal derangements that failed to improve after nonsurgical treatment.[15]

In 1996, Fridrich et al investigated the effect on pain reduction of lavage of the TMJ with and without arthroscopy. Arthroscopy and arthrocentesis seemed to be equally effective in reducing pain, which was confirmed by more recent studies as well.[16–21] However, not all of these studies were properly designed (ie, by randomized controlled trials [RCTs]), and most of them lacked a control group. Furthermore, Guo et al were the first to search systematically for the effectiveness of arthrocentesis of the TMJ compared to arthroscopy.[19] The main outcome of this study was again confirmative of the assumption that arthroscopy and arthrocentesis are equally effective with regard to pain. But here as well, the included studies lacked a nonsurgical control group.

Given this, to date a question more relevant to the patient as well as to the clinician is how effective is lavage of the TMJ (ie, arthrocentesis or arthroscopy) compared to nonsurgical therapy. Indeed, if lavage of the TMJ and nonsurgical therapy appear to be equally effective in reducing the symptoms, then the indication for this minimally invasive treatment would be doubtful, and would become more dependent on factors such as cost-effectiveness and treatment duration. Despite the relevance of this question, this has not been reviewed systematically. Part of this question was investigated in the systematic review of Rigon et al, who estimated the effect of arthroscopy compared to other treatment modalities.[22] However, arthroscopy seems to have no added value in effectiveness compared to arthrocentesis, and both treatment options are based on the same principle of lavage of the joint. An important part of the available evidence for the effectiveness of TMJ lavage is missed in their review, as arthrocentesis was not included as a thesaurus term in their search strategy.

Therefore, the following research objective was formulated a priori, using the PICOS approach: to carry out a systematic review of RCTs to investigate in patients with arthralgia of the TMJ the effectiveness of TMJ lavage compared to nonsurgical treatment with regard to pain intensity and mandibular range of motion.

Materials and Methods

Study selection, assessment of eligibility criteria, data extraction, and statistical analysis were specified in advance.

Retrieval of Published Studies

To retrieve articles investigating the efficacy of lavage as a treatment for TMJ arthropathies, a highly sensitive search strategy was performed in the databases of Medline (1966–2012), Embase (1966–2012), and Cochrane Central Register of Controlled Trials (CENTRAL) (1960–2012), with the last search on February 24, 2012. Because databases are organized by trees of specific thesaurus terms (medical subject headings [MeSH] or EMTREE terms), these trees were searched for relevant entry terms. The search strategy regarding the applied thesaurus terms (ie, MeSH in Medline and CENTRAL, and EMTREE terms in Embase) and text words in these databases is shown in Table 1. Furthermore, reference lists and citing reports of relevant articles were checked for missing articles to complete the search. Then titles, abstracts, and key words of all identified reports were screened to determine whether they were relevant to the topic under study. Relevant articles were included for full-text article eligibility assessment.

Inclusion and Exclusion Criteria

RCTs investigating the effectiveness of lavage compared to nonsurgical therapy for the treatment of TMJ arthropathy were included. Two reviewers (LMV, JJRHS) independently evaluated reports for eligibility. No language restrictions were applied throughout the article selection procedure.

Quality Assessment: Risk of Bias

Two reviewers (LMV, JJRHS) independently assessed the quality of each study. Strengths and weaknesses of the study design, implementation, and data

Table 1 Literature Search Strategy

	Search strategy Medline and CENTRAL*	Search strategy Embase†
#1	temporomandibular joint	temporomandibular joint
#2	temporomandibular joint disorders	temporomandibular joint disorders
#3	myofascial pain syndromes	myofascial pain
#4	craniomandibular disorders	craniomandibular
#5	#1 OR #2 OR #3 OR #4	#1 OR #2 OR #3 OR #4
#6	arthrocentesis	arthrocentesis
#7	arthroscopy	arthroscopy
#8	endoscopy	endoscopy
#9	#6 OR #7 OR #8	#6 OR #7 OR #8
#10	#5 AND #9	#5 AND #9

*Entry terms were used as MeSH terms as well as free text words.
†Entry terms were used as EMTREE terms as well as free text words.
CENTRAL = Cochrane central register of controlled trials; MeSH = Medical Subject Headings.

analysis of each study were analyzed. Disagreements on quality items were resolved by discussion.

Assessment items were:

1. Sequence generation and concealed allocation
2. Size and composition of the studied groups
3. Blinding of participants, clinicians, and investigators
4. Application of inclusion and exclusion criteria for subjects
5. Description of loss to follow-up
6. Adequacy of statistical analysis

Assessment items were scored "adequate," "unclear," or "inadequate." "Adequate" indicated a low risk of bias, "unclear" indicated a lack of information or uncertainty with regard to the potential bias, and "inadequate" indicated a high risk of bias due to inadequate handling of the item. Sequence generation and allocation concealment were considered adequate if the investigators could not suspect what treatment was next, prior to allocation. Size and composition of the groups were considered adequate if the size of different treatment groups was approximately equal and age and sex were equally distributed across groups. Furthermore, in the case of different diagnoses, these had to be distributed equally across the treatment groups as well. Blinding of participants, clinicians, and investigators was considered adequate if at least the investigators who analyzed the results were blinded for which group received which treatment. Blinding of the participants and clinicians could usually not be established due to the nature of the treatment modalities. Application of inclusion and exclusion criteria for subjects was considered adequate if these were described properly prior to the inclusion of subjects. Description of loss to follow-up was considered adequate if the number of withdrawals of each group was mentioned. Statistical analyses were considered adequate if all subjects were analyzed in the treatment group to which they were allocated, regardless of the treatment they received.

Data Extraction and Outcome Measures

Data from the included trials were extracted independently by two reviewers (LMV, JJRHS).

Main outcome data in each study consisted of sample size and measurements of pain and maximal mouth opening (MMO) and their standard deviations (SDs), at baseline and at 6 months follow-up. These data were calculated using individual patient data if they could be retrieved by contacting the authors. Otherwise, the published data were used. Relevant items for the data extraction also included study design, diagnosis, treatment modalities, follow-up period, dropout reports, and statistical analysis used.

Statistical Analysis

All analyses were based on the reported data of the included studies or the raw data if retrieved from the authors. As pain intensity and MMO are continuous variables, standardized mean differences (SMDs) and corresponding SDs were calculated for each study. For both outcome measurements, heterogeneity was calculated separately using I^2 statistics, which gives the percentage of total variation across trials that can be attributed to heterogeneity rather than to chance. Meta-analysis was performed to provide the overall SMD and 95% confidence interval (CI) for pain intensity and MMO by using a fixed effects model. Depending on the I^2 statistics, a random effects model was performed when eligible.

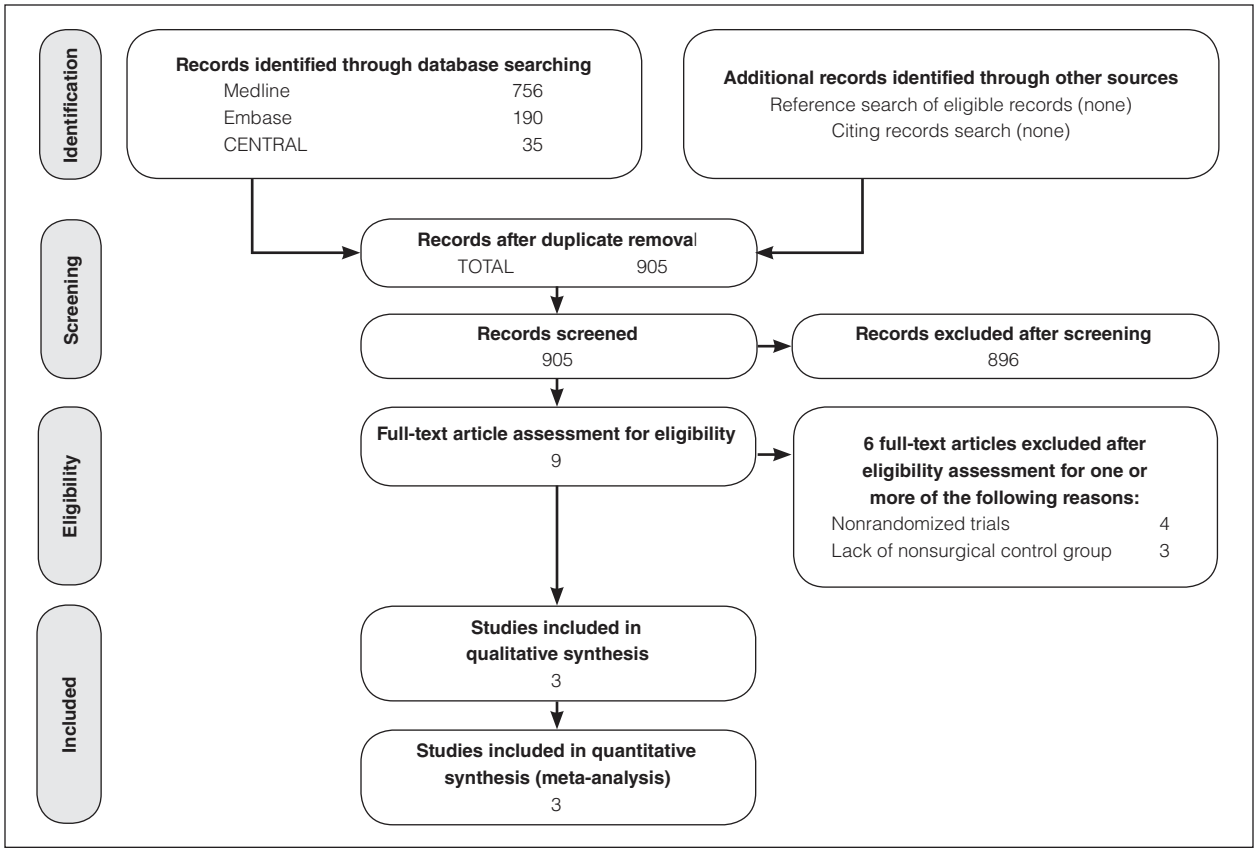

Fig 1 Flow chart of the study selection procedure.

Results

A total of 756 articles were identified in Medline. Out of 190 identified articles in Embase, 146 were additional to the articles identified in Medline. In the Cochrane Central Register of Controlled Trials, three additional articles were identified out of 35. Of the articles selected for full-text article eligibility assessment, all cited references and all citing reports were checked, which did not result in additional articles (Fig 1).

Included Studies

All included studies[4,23,24] were RCTs investigating the effectiveness of TMJ lavage compared to nonsurgical treatment. Of these three included studies, Diraçoğlu et al[23] and Stegenga et al[4] used a visual analog scale (VAS) or pain scale to measure pain intensity and MMO for measurement of the range of motion of the mandible. Only Schiffman et al[24] did not report a pain score or the MMO before and after treatment. By contacting the authors of all three included studies, individual patient data, as well as additional information on the quality of the study, were retrieved in only one of the three studies.[24] The authors of the other two studies[4,23] did not provide additional information. The individual patient data included the pain score and MMO data that were missing in the report of Schiffman et al.[24] The major characteristics of the included studies are summarized in Table 2.

Excluded Studies

Out of the nine articles included for full text reading, three articles matched the inclusion criteria. Of the six excluded articles,[17,25–29] four articles were excluded because the study design was not a RCT.[17,25,26,28] Furthermore, three of the six excluded studies were lacking a nonsurgical control group.[25,27,29] The major characteristics of the excluded studies are summarized in Table 3.

Description of the Included Studies

An overview of the extracted data and risk of bias assessment of included studies is shown in Table 2, and of the excluded studies after application of the inclusion and exclusion criteria in Table 3.

Table 2 Extracted Data of Included Studies

Criteria	Diraçoğlu et al[23]	Schiffman et al[24]	Stegenga et al[4]
Sequence generation and concealed allocation	Uncertain	Adequate	Adequate
Size and composition of the studied groups	Adequate	Adequate	Uncertain
Blinding of participants, clinicians, and investigators	Uncertain	Uncertain	Uncertain
Application of inclusion and exclusion criteria for subjects	Adequate	Adequate	Adequate
Description of loss to follow-up	Adequate	Adequate	Adequate
Adequacy of statistical analysis	Adequate	Adequate	Adequate
Design	RCT	RCT	RCT
Diagnosis	DDw/oR	Closed lock stage III or IV	Arthrosis
Patients	120 (10 loss to follow-up)	81 (11 loss to follow-up)	21
Treatment modality	AS NS (Combination of splint, hot pack, and home exercising)	AS NS (Rehabilitation) MM	AR NS
Follow-up (months)	6	6	6
Pretreatment/posttreatment mean VAS or pain score ± SD	AS: 6.3 ± 2.3 / 1.5 ± 1.8 NS: 5.7 ± 2.4 / 4.4 ± 2.3	AS: 6.8 ± 2.1 / 3.3 ± 2.2 NS: 6.0 ± 2.0 / 2.9 ± 2.2 MM: 5.6 ± 2.5 / 3.0 ± 1.9	AR: 56 ± 21 / 11 ± 15 NS: 34 ± 17 / 9 ± 14
Pretreatment/posttreatment mean MMO ± SD	AS: 31.2 ± 7.0 / 37.9 ± 6.5 NS: 29.9 ± 4.8 / 35.5 ± 6.4	AS: 33.4 ± 7.6 / 41.0 ± 8.2 NS: 32.0 ± 4.6 / 42.2 ± 6.4 MM: 32.5 ± 5.2 / 39.9 ± 5.2	AR: 27.6 ± 4.2 / 34.2 ± 3.6 NS: 31.4 ± 3.8 / 39.5 ± 5.5

RCT, randomized controlled trial; DDw/oR, disc displacement without reduction; AS, athrocentesis; AR, arthroscopy; NS, nonsurgical; MM, medical management; VAS, visual analog scale; SD, standard deviation; MMO, maximal mouth opening.

Table 3 Extracted Data of Excluded Studies

Study	Design	Diagnosis	Patients/ joints	Treatment modality	Follow-up (mo)	Pretreatment/ posttreatment mean VAS pain score ± SD	Pretreatment/ posttreatment mean MMO ± SD
Goudot et al[17]	Prospective clinical trail	TMJ pain and dysfunction syndrome	708	Ph Ps AS/AR	12	Not available	Not available
Hall et al[25]	Controlled prospective clinical trail	Painful TMJ with internal derangement	54/78	AR C D DR	12	AR: 5.3 ± 3.7 / 0.8 ± 1.2 C: 6.6 ± 2.2 / 1.7 ± 3.3 D: 7.0 ± 2.3 / 1.0 ± 1.8 DR: 7.1 ± 2.9 / 1.6 ± 2.3	AR: 31.2 ± 8.6 / 42.3 ± 7.7 C: 34.9 ± 11.1 / 44.3 ± 9.7 D: 32.0 ± 6.0 / 39.3 ± 4.7 DR: 30.6 ± 7.9 / 36.8 ± 3.4
Kurita et al[26]	Prospective outcome	DDw-w/oR	28/35	ALL NS	20	ALL: 56.6 ± 27.1 / 7.6 ± 8.7 NS: 39.3 ± 31.3 / 9.7 ± 8.6	ALL: 23 ± 5.9 / 38.6 ± 7.1 NS: 30.7 ± 10.6 / 41.9 ± 5.5
Miyamoto et al[27]	RCT	Internal derangement stage III or more	101/104	ALL ALLCR	12	Pain score in: Mild, Medium, or Severe	ALL: 26 ± 4 / 44 ± 4 ALLCR: 27 ± 5 / 44 ± 5
Murakami et al[28]	Prospective clinical trail	Wilkes stage III with closed lock	108/116	AS AR NS	12	AS: 4.8 ± 2.5 / 1.7 ± 1.1 AR: 5.7 ± 2.5 / 1.2 ± 1.5 NS: 5.1 ± 2.8 / 2.2 ± 2.3	AS: 30.6 ± 5.8 / 42.5 ± 5.6 AR: 27.5 ± 5.8 / 42.1 ± 5.3 NS: 29.8 ± 7.5 / 38.9 ± 8.1
Politi et al[29]	RCT	Chronic closed lock	20	AR OS	12	AR: 7.9 / 1.9 OS: 8.0 / 1.3	AR: 2 / 7 OS: 0 / 8

VAS, visual analog scale; SD, standard deviation; MMO, maximal mouth opening; Ph, physiotherapy; Ps, psychological therapy; AS, arthrocentesis; AR, arthroscopy; C, condylectomy; D, discectomy; DR, Disc repositioning; DDw-w/oR, disc displacement with or without reduction; ALL, arthroscopic lysis and lavage; NS, nonsurgical; ALLCR, arthroscopic lysis and lavage plus arthroscopic anterolateral capsular release; OS, open surgery; RCT, randomized controlled trial.

Diraçoğlu et al[23] enrolled 120 patients (104 females, 16 males) with the diagnosis disc displacement without reduction. The study design was a quasi-randomized single-blind prospective study comparing arthrocentesis with conventional treatment consisting of a combination of splint therapy, hot pack, and a home exercise program. Patients were allocated to one of the treatment modalities according to their admission to the TMJ unit (consecutively one to each group). The arthrocentesis group consisted of 54 patients (51 females, 3 males), while 56 patients (49 females, 7 males) underwent conventional treatment. The mean age in these groups was 33.4 years (range 15 to 63 years) and 34.8 years (range 17 to 61 years), respectively. Baseline VAS for pain intensity and baseline MMO were similar in both groups. Posttreatment assessments were performed after 1.3 and 6 months. No withdrawal of patients was reported. Improvement from baseline was tested in each group by paired *t* tests. A repeated-measures analysis of variance (ANOVA) was used for intergroup comparison.

Schiffman et al[24] included 106 patients with disc displacement without reduction with limited mouth opening (closed lock). The study design was a randomized single-blind prospective trial comparing medical management, rehabilitation, arthroscopic surgery with postoperative rehabilitation, and arthroplasty with postoperative rehabilitation. Patients were randomly allocated to one of the treatment modalities, based on a concealed randomization schedule. According to the intention-to-treat analysis, 29 patients (26 females, 3 males, mean age 33.7 years, SD 1.8 years) were analyzed in the medical management group, 25 patients (25 females, mean age 30.0 years, SD 1.7 years) in the rehabilitation group, 26 patients (22 females, 4 males, mean age 31.8 years, SD 1.7 years) in the arthroscopy group, and 26 patients (25 females, 1 male, mean age 31.4 years, SD 1.9 years) in the arthroplasty group. Pain intensity and mandibular range of motion were measured in this study but were not reported in the published article. These measurements were retrieved by contacting the authors. Posttreatment assessments were performed after 3, 6, 12, 18, 24, and 60 months. In the rehabilitation and the arthroscopic surgery group, 2 patients were lost to follow-up. In the arthroplasty surgery group, 4 patients were lost to follow-up. Improvement from baseline was tested in each group by paired *t* tests. Repeated-measures ANOVA was used for intergroup comparison.

Stegenga et al[4] recruited 21 patients (19 females, 2 males, mean age 23.7 years, SD 6.7 years, range 17 to 41 years) with arthrosis of the TMJ. The study design was a RCT comparing arthroscopic surgery, followed by postoperative physical therapy, to nonsurgical treatment. Patients were randomly assigned to one of the treatment groups. The arthroscopic surgery group consisted of 9 patients. The nonsurgical group contained 12 patients. Posttreatment assessments were performed after 4 weeks and 6 months. At the 6-month evaluation, data could be obtained from all patients. Repeated-measures multivariate analysis of variance (MANOVA) was carried out to test for possible differences between the types of treatment (effect: treatment type) as well as pretreatment versus posttreatment differences (effect: pre vs post). When a significant difference was found, post-hoc univariate ANOVA was used to detect the relative contribution of the component variables.

Effects of Interventions

Individual Study Results. Diraçoğlu et al[23] found that VAS values were significantly more reduced in the arthrocentesis group after 6 months than in the nonsurgical group ($P < .01$). Differences between groups in improvement of MMO were not significant after 6 months ($P > .05$). In a within-group analysis, both groups showed significant improvement at 6 months compared to baseline for VAS scores as well as for the MMO ($P < .01$).

In the study of Schiffman et al,[24] VAS values were not significantly more reduced in the arthrocentesis group after 6 months than in the nonsurgical group ($P = .14$). Differences between these two groups in improvement of MMO were also not significant after 6 months ($P = .52$).

The results of the study of Stegenga et al[4] showed that VAS values were significantly more reduced in the arthroscopy group after 6 months than in the nonsurgical group ($P < .05$). Differences between groups in improvement of MMO were not significant after 6 months ($P > .05$). Improvement was significant for both groups after 6 months compared to baseline for VAS values as well as for MMO ($P < .001$).

Pooled Treatment Effect Results. The SMDs of the individual studies were pooled using a fixed effects model. There was a high degree of inconsistency when a fixed effects model was applied and a low degree of inconsistency among the trials for the random effects model ($I^2 = 88.2\%$ fixed and 0.0% random) for pain intensity and also a low degree of inconsistency ($I^2 = 0.0\%$ fixed and 0.0% random) for MMO. Regarding the pooled SMD of the VAS scores, there was a significant difference between TMJ lavage and nonsurgical treatment at the 6-month posttreatment assessment compared to baseline

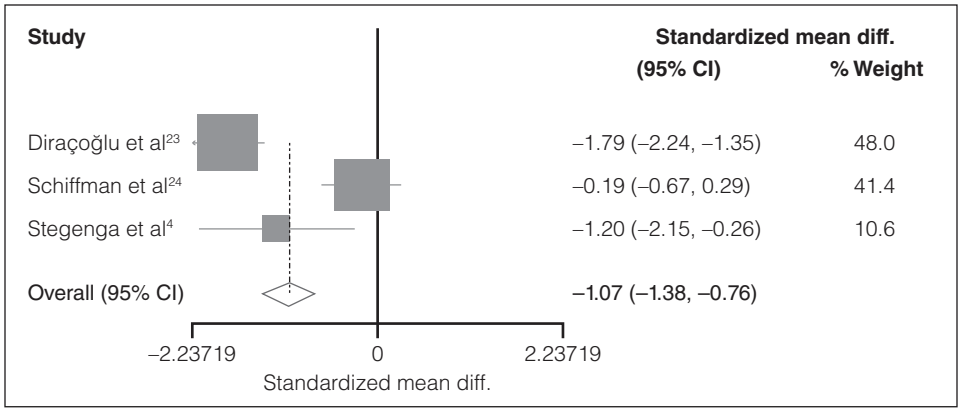

Fig 2 Forest plot of the pooled effect sizes of the pain scales (random effects model). CI, confidence interval.

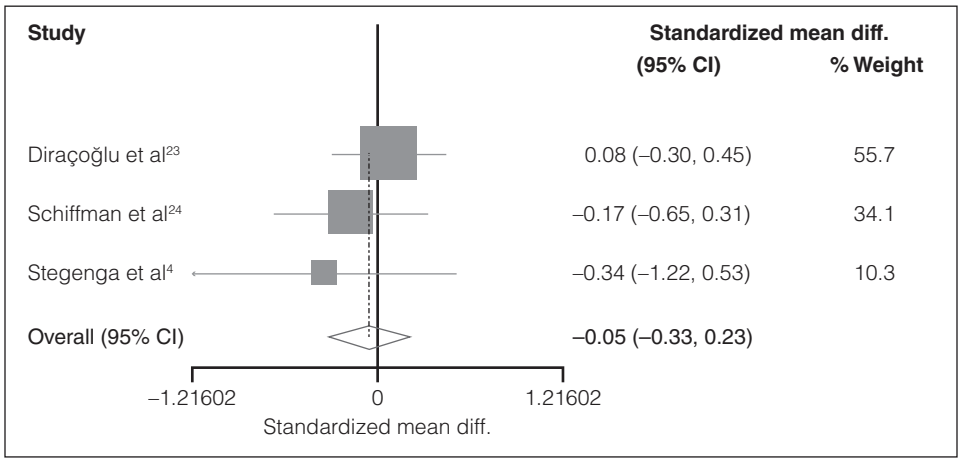

Fig 3 Forest plot of the pooled effect sizes of the MMO (random effects model). CI, confidence interval.

($P < .001$). The overall SMD was –1.07 (95% CI = 1.38, –0.76). However, the pooled effect of MMO did not differ significantly between TMJ lavage and nonsurgical treatment at the 6-month posttreatment assessment compared to baseline measurements ($P > .05$; SMD = .05 [95% CI = –0.33, 0.23]). The SMDs of the individual studies and the pooled SMD are shown in Figs 2 (VAS) and 3 (MMO). In the forest plots shown, for the studies of Diraçoğlu et al[23] and Stegenga et al[4] a comparison was performed between the nonsurgical group and the arthrocentesis group. With regard to the study of Schiffman et al,[24] the rehabilitation group and the medical management group were combined to one nonsurgical treatment group, because rehabilitation and medical management are both nonsurgical treatment options. This combined nonsurgical group was compared with the arthrocentesis group. The pooled SMD was also calculated for when only the rehabilitation group or only the medical management group was applied as the nonsurgical group in the study of Schiffman et al.[24] However, this did not significantly influence the pooled SMD.

Discussion

Overall, the robustness of the evidence to determine the effectiveness of lavage of the TMJ compared to nonsurgical treatment with regard to outcome measurements for pain and mandibular range of motion is questionable. Three RCTs compared lavage of the TMJ directly to nonsurgical therapy modalities. The overall quality of these studies was adequate, although there were several serious limitations. Although the three most prominent databases were searched, it is possible that important studies not included in one of these databases were missed. Only one study[24] reported randomization concealment, whereas another study[23] reported nonconcealment of the allocation. Two of the three included studies[4,23] did not explicitly state that analysis of data adhered to an intention-to-treat principle, which could lead to overestimation of the treatment effect. One of the studies had a small sample size,[4] and as the data of the three eligible studies were pooled, still only 85 patients who received TMJ lavage attended

the 6-month posttreatment assessment. This sample size is still rather small and depends largely on the study of Diraçoğlu et al.[23] Furthermore, none of the included studies reported blinding of the investigators as to which group received which treatment. Blinding of the participants and clinicians could not be established due to the nature of the treatment modalities. The follow-up period of the studies was at least 6 months, which can be considered sufficient with regard to the outcome measurements of interest in this review. Indeed, pain relief and improvement of mandibular range of motion should occur and stabilize within 6 months to indicate a treatment modality effective in treating arthralgia of the TMJ.

The aim of the meta-analysis reported here was to estimate treatment effects with more precision than is possible in a single study. Nevertheless, differences between lavage and nonsurgical treatment seem to be very small. And although differences in VAS scores appear statistically significant, their clinical relevance may be negligible, as it reflected only 1.07 points on the VAS. Limitations for the meta-analysis are differences in diagnosis and variety of treatment modalities within the nonsurgical treatment groups across studies. Due to the variety of treatment modalities in the nonsurgical groups, some treatment modalities within these groups may have contributed more to the nonsurgical group mean than others. Consequently, the difference between the effectiveness of TMJ lavage may be overestimated for some nonsurgical treatment modalities and underestimated for others. Furthermore, one of the studies[20] did not report loss to follow-up, which introduces risk of bias if there were unreported withdrawals.

Conclusions

Implications for Practice

This is the first meta-analysis that compared lavage of the TMJ to nonsurgical treatment modalities for TMJ arthropathy. The findings reported in the present review suggest that lavage of the TMJ may be slightly more effective than nonsurgical treatment in reducing pain. By contrast, superiority of lavage of the TMJ for improvement in mandibular movement could not be supported by the available evidence. Since lavage of the TMJ may be slightly more effective, these findings may indicate that lavage of the TMJ may be a useful alternative in cases where pain is the most prominent symptom.

Implications for Research

In this systematic review, only VAS scores for the measurement of pain intensity and MMO scores were extracted from the studies for a pooled effect size calculation. Because pain and decreased range of mandibular motion are usually the main complaints of the patients suffering from TMJ arthropathy, these two variables seemed most accurate for determining the effectiveness of arthroscopy or arthrocentesis. However, to provide a more complete picture for the effectiveness of minimally invasive procedures, it may be worthwhile to include cost-effectiveness of the different treatment modalities and patient satisfaction as well.

Acknowledgments

The authors reported no conflicts of interest related to this study.

References

1. Barros Vde M, Seraidarian PI, Côrtes MI, de Paula LV. The impact of orofacial pain on the quality of life of patients with temporomandibular disorders. J Orofac Pain 2009; 23:28–37.
2. John MT, Reissmann DR, Schierz O, Wassell RW. Oral health-related quality of life in patients with temporomandibular disorders. J Orofac Pain 2007;21:46–54.
3. de Bont LGM, Boering G, Liem RSB, Eulderink F, Westesson PL. Osteoarthritis and internal derangement of the temporomandibular joint: A light microscopic study. J Oral Maxillofac Surg 1986;44:634–643.
4. Stegenga B, de Bont LGM, Dijkstra PU, Boering G. Short-term outcome of arthroscopic surgery of temporomandibular joint osteoarthrosis and internal derangement: A randomized controlled clinical trial. Br J Oral Maxillofac Surg 1993;31:3–14.
5. de Bont LGM, Stegenga B. Pathology of temporomandibular joint internal derangement and osteoarthrosis. Int J Oral Maxillofac Surg 1993;22:71–74.
6. Laskin DM. Arthrocentesis for the treatment of internal derangements of the temporomandibular joint. Alpha Omegan 2009;102:46–50.
7. Zhang S, Liu X, Yang C, et al. Intra-articular adhesions of the temporomandibular joint: Relation between arthroscopic findings and clinical symptoms. BMC Musculoskelet Disord 2009;10:70.
8. List T, Axelsson S. Management of TMD: Evidence from systematic reviews and meta-analyses. J Oral Rehabil 2010;37: 430–451.
9. Al-Ani MZ, Davies SJ, Gray RJ, Sloan P, Glenny AM. Stabilization splint therapy for temporomandibular pain dysfunction syndrome. Cochrane Database Syst Rev 2004;1: CD002778.
10. Ohnishi M. Arthroscopy of the temporomandibular joint. Kokubyo Gakkai Zasshi 1975;42:207–213.
11. Ohnishi M. Clinical application of arthroscopy in the temporomandibular joint diseases. Bull Tokyo Med Dent Univ 1980;27:141–150.

12. González-García R, Rodríguez-Campo FJ, Monje F, Román-Romero L, Sastre-Pérez J, Usandizaga JL. Influence of the upper joint surface and synovial lining in the outcome of chronic closed lock of the temporomandibular joint treated with arthroscopy. J Oral Maxillofac Surg 2010;68:35–42.
13. Nitzan DW. Arthrocentesis—incentives for using this minimally invasive approach for temporomandibular disorders. Oral Maxillofac Surg Clin North Am 2006;18:311–328, vi.
14. Al-Belasy FA, Dolwick MF. Arthrocentesis for the treatment of temporomandibular joint closed lock: A review article. Int J Oral Maxillofac Surg 2007;36:773–782.
15. Barkin S, Weinberg S. Internal derangements of the temporomandibular joint: The role of arthroscopic surgery and arthrocentesis. J Can Dent Assoc 2000;66:199–203.
16. Fridrich KL, Wise JM, Zeitler DL. Prospective comparison of arthroscopy and arthrocentesis for temporomandibular joint disorders. J Oral Maxillofac Surg 1996;54:816–820.
17. Goudot P, Jaquinet AR, Hugonnet S, Haefliger W, Richter M. Improvement of pain and function after arthroscopy and arthrocentesis of the temporomandibular joint: A comparative study. J Craniomaxillofac Surg 2000;28:39–43.
18. Currie R. Temporomandibular joint arthrocentesis and lavage. Evid Based Dent 2009;10:110.
19. Guo C, Shi Z, Revington P. Arthrocentesis and lavage for treating temporomandibular joint disorders. Cochrane Database Syst Rev 2009;7:CD004973.
20. Hobeich JB, Salameh ZA, Ismail E, Sadig WM, Hokayem NE, Almas K. Arthroscopy versus arthrocentesis. A retrospective study of disc displacement management without reduction. Saudi Med J 2007;28:1541–1544.
21. White RD. Arthroscopic lysis and lavage as the preferred treatment for internal derangements of the temporomandibular joint. J Oral Maxillofac Surg 2001;59:313–316.
22. Rigon M, Pereira LM, Bortoluzzi MC, Loguercio AD, Ramos AL, Cardoso JR. Arthroscopy for temporomandibular disorders. Cochrane Database Syst Rev 2011;11:CD006385.
23. Diraçoğlu D, Saral IB, Keklik B, et al. Arthrocentesis versus nonsurgical methods in the treatment of temporomandibular disc displacement without reduction. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;108:3–8.
24. Schiffman EL, Look JO, Hodges JS, et al. Randomized effectiveness study of four therapeutic strategies for TMJ closed lock. J Dent Res 2007;86:58–63.
25. Hall HD, Indresano AT, Kirk WS, Dietrich MS. Prospective multicenter comparison of 4 temporomandibular joint operations. J Oral Maxillofac Surg 2005;63:1174–1179.
26. Kurita H, Chen Z, Uehara S, Miyazawa H, Nishiura R. Comparison of imaging follow-up between joints with arthroscopic surgery (lysis and lavage) and those with nonsurgical treatment. J Oral Maxillofac Surg 2007;65:1309–1314.
27. Miyamoto H, Sakashita H, Miyata M, Goss AN. Arthroscopic surgery of the temporomandibular joint: Comparison of two successful techniques. Br J Oral Maxillofac Surg 1999;37:397–400.
28. Murakami K, Hosaka H, Moriya Y, Segami N, Iizuka T. Short-term treatment outcome study for the management of temporomandibular joint closed lock. A comparison of arthrocentesis to nonsurgical therapy and arthroscopic lysis and lavage. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1995;80:253–257.
29. Politi M, Sembronio S, Robiony M, Costa F, Toro C, Undt G. High condylectomy and disc repositioning compared to arthroscopic lysis, lavage, and capsular stretch for the treatment of chronic closed lock of the temporomandibular joint. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2007;103:27–33.