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Randomised Controlled Trial

TMJ Disorders

Arthrocentesis versus non-surgical intervention as initial treatment for temporomandibular joint arthralgia: a randomized controlled trial with long-term follow-up

Y.H. Tang[a], L.M. Vos[b], A.J. Tuin[a], J.J.R. Huddleston Slater[a], B. Gareb[a], N.B. van Bakelen[a], F.K.L. Spijkervet[a]

[a]Department of Oral and Maxillofacial Surgery, University Medical Center Groningen, University of Groningen, Groningen, the Netherlands; [b]Department of Oral and Maxillofacial Surgery, Wilhelmina Hospital Assen, Assen, the Netherlands

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Abstract. Arthrocentesis for arthralgia of the temporomandibular joint (TMJ) is often only indicated when conservative, non-surgical interventions have failed. However, performing arthrocentesis as initial therapy may facilitate earlier and better recuperation of the joint. The aim of this study was to assess the efficacy of this therapy with a long-term follow-up. Eighty-four patients were randomly allocated to receive either arthrocentesis as initial treatment (n = 41) or non-surgical intervention (n = 43). Pain (100-mm visual analogue scale, VAS) and mandibular function impairment questionnaire scores (MFIQ, 0–100) were recorded at 3, 12, and 26 weeks, and ≥ 5 years (median 6.2, interquartile range 5.6–7.4 years). Univariable analyses were performed and linear mixed-effect models were constructed. Patients in the arthrocentesis group experienced significantly lower TMJ arthralgia compared to those treated non-surgically (pain during movement: −10.23 mm (95% confidence interval −17.86; −2.60); pain at rest: − 8.39 mm (95% confidence interval −13.70; −3.08)), while mandibular function remained similar in the two groups (MFIQ −2.41 (95% confidence interval −8.61; 3.78)). Of the final sample, 10 patients (10/39, 26%) in the non-surgical intervention group and two patients (2/34, 6%) in the arthrocentesis group received additional treatment during follow-up. Thus, initial treatment with arthrocentesis reduced TMJ arthralgia more efficaciously than non-surgical intervention in the long term, while maintaining similar mandibular function.

Keywords: Therapeutic irrigation; Conservative treatment; Occlusal splint; Physical therapy; Osteoarthritis; Pain; Minimally invasive surgical procedures; Craniomandibular disorders.

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Arthralgia of the temporomandibular joint (TMJ) is a frequently occurring and debilitating problem, affecting an estimated 8% of the population.[1] Although a multitude of causes may give rise to TMJ arthralgia, degenerative joint disease (DJD; i.e., osteoarthritis) and internal derangement (ID) are amongst the leading causes.[2] About 75% of patients with symptomatic DJD have some type of ID, while approximately 50% of all patients with symptomatic ID experience DJD to some degree.[3] Despite often being observed simultaneously, the two conditions are different entities and do not necessarily precede each other.[4]

In both DJD and ID, the manifestation of symptoms often indicates a disturbance in the homeostasis of the articular tissue, where degenerative processes exceed the joint's adaptive capability for tissue synthesis and rehabilitation.[2,4] Here, the synovial fluid of the TMJ contains elevated levels of proinflammatory cytokines, matrix degradation enzymes, and breakdown products that cannot easily be cleared from the synovial cavity.[4–6] A secondary inflammatory response may arise subsequently, which is often accountable for most symptoms such as arthralgia, restricted mouth opening, blockages, and joint noise.[4,7]

Arthrocentesis may be performed to remove the inflammatory mediators and degradation products that are thought to be responsible for the clinical symptoms; this involves lavage of the upper TMJ compartment.[8–10] However, current management regimens often only indicate arthrocentesis if conservative, non-surgical interventions, based primarily on load reduction and the prescription of non-steroidal anti-inflammatory drugs (NSAIDs), prove to be insufficient in reducing symptoms.[2,11] Previous studies performed at the authors' institution (University Medical Center Groningen) showed that arthrocentesis as the initial treatment for TMJ arthralgia was more efficacious in reducing clinical symptoms[8] and was more cost-effective[12] than conservative, non-surgical intervention after 6 months of follow-up. However, limited evidence exists regarding the long-term efficacy of the immediate performance of arthrocentesis, particularly when compared to other therapies.

Therefore, the aim of this study was to determine the efficacy of arthrocentesis as the initial treatment modality in reducing TMJ arthralgia, compared to non-surgical intervention, during long-term follow-up of ≥ 5 years.

Materials and methods

The 2010 CONSORT guidelines were followed in the reporting of this study. The study was conducted in accordance with the principles of the Declaration of Helsinki (adapted version 2013, Fortaleza, Brazil) and the Dutch 'Medical Research Involving Human Subjects Act' (WMO).

Clinical trial design

This single-centre randomized controlled trial was performed in the Department of Oral and Maxillofacial Surgery of the University Medical Center Groningen (UMCG), the Netherlands. Study subjects were recruited between January 2009 and July 2012. Approval was given by the Institutional Review Board of UMCG (METc 2008/197) and signed informed consent was obtained from all of the study participants prior to the commencement of any study-related procedures.

Study population

The study patients were recruited from the outpatient clinic of the Department of Oral and Maxillofacial Surgery of UMCG. A sample size calculation was performed for the primary outcome measure for the initial follow-up period of the study, as described previously.[8] The inclusion criteria were age ≥ 16 years, pain in the TMJ region aggravated by mandibular movement (i.e., protrusion, maximal mouth opening, and/or lateral excursions) and/or during function, the presence of TMJ arthralgia after 2 weeks of 600 mg ibuprofen three times daily (to exclude acute inflammatory pain), and the disappearance of TMJ arthralgia after a diagnostic intra-articular injection with a local anaesthetic in the TMJ (Ultracain D-S Forte; Sanofi, Amsterdam, the Netherlands; to exclude myogenous pain).[13]

The exclusion criteria were systemic rheumatic disease, bony ankylosis of the TMJ, prior open TMJ surgery, pregnancy, concurrent use of anti-inflammatory drugs, muscle relaxants, anti-depressants, and/or steroids, other medical contraindications, unwillingness to receive either study treatment, and the inability to speak Dutch or English.

Study procedures

The study patients were randomly allocated (1:1 ratio) to either the treatment group (arthrocentesis) or the control group (non-surgical intervention, NS) for initial treatment, by an independent colleague, using randomization software (StatsDirect version 2.7.7; StatsDirect Ltd, Birkenhead, United Kingdom). Patient allocation to the initial treatment modality was concealed from the physicians and researchers using opaque, sequentially numbered, sealed envelopes. An independent nurse revealed the group allocation once the patient had agreed to participate in the study.

The patients allocated to arthrocentesis underwent lavage of the upper TMJ space with at least 300 ml isotonic saline, while the patients allocated to the NS group had to follow a strict soft diet protocol for at least 6 weeks. Patients in the NS group who received additional physical therapy and/or splint therapy were carefully selected during a critical interim evaluation, 2 weeks after the start of the soft diet protocol. Physical therapy was provided if the maximum mouth opening did not improve, while splint therapy was provided if the pain did not subside.

All of the arthrocentesis procedures were performed under local anaesthesia by a single oral and maxillofacial surgeon (B. Stegenga). Further details of the procedure have been reported previously.[8] Prior to treatment, panoramic radiographs, transcranial radiographs (Schüller projection), and transpharyngeal radiographs (Parma projection) of the TMJ were obtained and examined to evaluate the degree of osseous degeneration. The evaluation of the radiographic images and DJD diagnosis were done according to the criteria described by Ahmad et al.[14] (Supplementary Material Table S1). The ID diagnostic categories were determined according to the Diagnostic Criteria for Temporomandibular Disorders (DC/TMD),[15] based on patient history and clinical examination (Supplementary Material Table S2).

Outcome measures

The main outcome parameter of the study was the extent of TMJ pain, according to a visual analogue scale

(VAS), during mandibular movement (and/or function) (VASm; 0–100 mm, with 0 indicating no pain). The secondary outcome measures were TMJ pain at rest (VASr; 0–100 mm, with 0 indicating no pain), mandibular function impairment as determined using the validated Mandibular Function Impairment Questionnaire (MFIQ; 0–100),[16] and the number of patients who needed additional treatment during follow-up. A higher MFIQ score indicates worse mandibular function. The outcome measures were recorded at baseline and at four follow-up time points: 3, 12, and 26 weeks (in the outpatient clinic) and ≥ 5 years (via telephone interview). The patients who received additional treatment during follow-up due to insufficient symptom reduction after the primary treatment were registered.

Statistical analysis

Normally distributed variables were presented as the mean and standard deviation (SD) values. Non-normally distributed continuous variables were presented as the median with the first and third quartiles (interquartile range, IQR) and compared using the Mann–Whitney *U*-test. The assumption of a normal distribution of continuous data was assessed by visually examining the Q–Q plot and the Shapiro–Wilk test. All categorical variables were described as frequencies with percentages and compared using Fisher's exact test. The analyses were performed using IBM SPSS Statistics for Windows, version 23 (IBM Corp., Armonk, NY, USA). Graphs were drawn using Prism, version 9 (GraphPad Software Inc., San Diego, CA, USA). Linear mixed-effect models (LMM) were fitted to assess the effect of the interventions on repeated measurements of VASm, VASr, and MFIQ. Simple multivariable models included the fixed effects of the type of intervention and follow-up in weeks. The full multivariable models included the fixed effects of the baseline score, type of intervention, follow-up in weeks, sex, age, presence and type of ID, degree of DJD seen on radiographic imaging, and any additional treatments. These variables were selected because of their prognostic nature and based on model improvement.[17] Additional treatments were included as time-varying variables by taking into account at which point during follow-up the additional treatments were performed. The included random effects were the participants. Additionally, the fixed interaction between the intervention and time and/or the random effect of time were only included if the term significantly improved the multivariable model. Between models, model improvement was tested using likelihood ratio tests. Participants were only included in the analysis if the baseline and at least one follow-up measurement of one or more outcome variables were recorded. All models yielded an estimated regression coefficient (β) with corresponding 95% confidence interval (95% CI). $P \leq 0.05$ (two-tailed) was considered statistically significant. All of the LMM analyses were performed in R, version 4.0.5 (R Core team; R Foundation for Statistical Computing, Vienna, Austria), using the lme4 package.[18]

Results

A total of 84 patients were initially enrolled in the study (Fig. 1). Of these, 41 were allocated to receive arthrocentesis and 43 to receive NS (Table 1). After randomization, 11 patients were excluded from the statistical analysis: seven (17%) from the arthrocentesis group and four (9%) from the NS group. The reasons for exclusion are presented in Fig. 1.

The final arthrocentesis group included 25 female patients (74%) and nine male patients (26%); median age was 27 years (IQR 23–50 years). The final NS group included 32 female patients (82%) and seven male patients (18%); median age was 29 years (21–41 years). The median time interval between the baseline and the latest follow-up (≥5 years) was 6.2 years (IQR 5.6–7.4 years).

All of the NS patients adhered to the strict soft diet protocol. Ten patients (26%) in the NS group received additional physical therapy, 15 (38%) received additional splint therapy, and two (5%) received both additional physical and splint therapy. Also, 10 patients in the NS group (26%) underwent additional arthrocentesis during follow-up (at a median of 41 weeks (IQR 30–80 weeks)); the study outcomes of six of these patients (15%) were recorded after the additional procedure (at a median 41 weeks (IQR 25–104 weeks)).

In the arthrocentesis group, two patients (6%) received additional treatment: one patient underwent another arthrocentesis (after 75 weeks) and subsequently diagnostic arthroscopy (after 136 weeks); one patient received a methylprednisolone injection against the joint capsule (after 8 weeks). No serious adverse events were recorded; four patients experienced mild temporary swelling around the TMJ directly after arthrocentesis.

The median scores of the outcome variables VASm, VASr, and MFIQ over time are presented in Fig. 2; the scores at the latest follow-up are reported in Table 2. The simple multivariable LMM analysis indicated a significantly lower VASm in the arthrocentesis group compared to the NS group (−11.13 mm (95% CI −20.04; −2.21)), as shown in Table 3. Of the secondary outcome measures, VASr was significantly lower in the arthrocentesis group (−8.72 mm (95% CI −16.23; −1.21)), whereas the MFIQ score did not differ significantly between the treatment groups (−3.89 (95% CI −11.16; 3.37)) (Table 3).

In the full multivariable model, there was no fixed interaction between intervention and time and/or the random effect of time did not significantly improve the model (VASm ($P = 0.971$); VASr ($P = 0.888$); MFIQ ($P = 0.298$)). In this model, VASm was significantly lower in the arthrocentesis group compared to the NS group over the entire follow-up (−10.23 mm (95% CI −17.86; −2.60)) (Table 3). Of the secondary outcome measures, VASr was significantly lower in the arthrocentesis group (−8.39 mm (95% CI −13.70; −3.08)). However, the MFIQ score did not differ significantly between the treatment groups (−2.41 (95% CI −8.61; 3.78)) after adjustment for confounders (Table 3).

In the full multivariable model, the overall presence of ID or DJD had no significant influence on the outcome measures when compared to patients with, respectively, no clinical signs of ID or radiological signs of DJD (Table 3).

Discussion

The aim of this study was to evaluate the efficacy of arthrocentesis as the initial treatment for TMJ arthralgia compared to non-surgical intervention

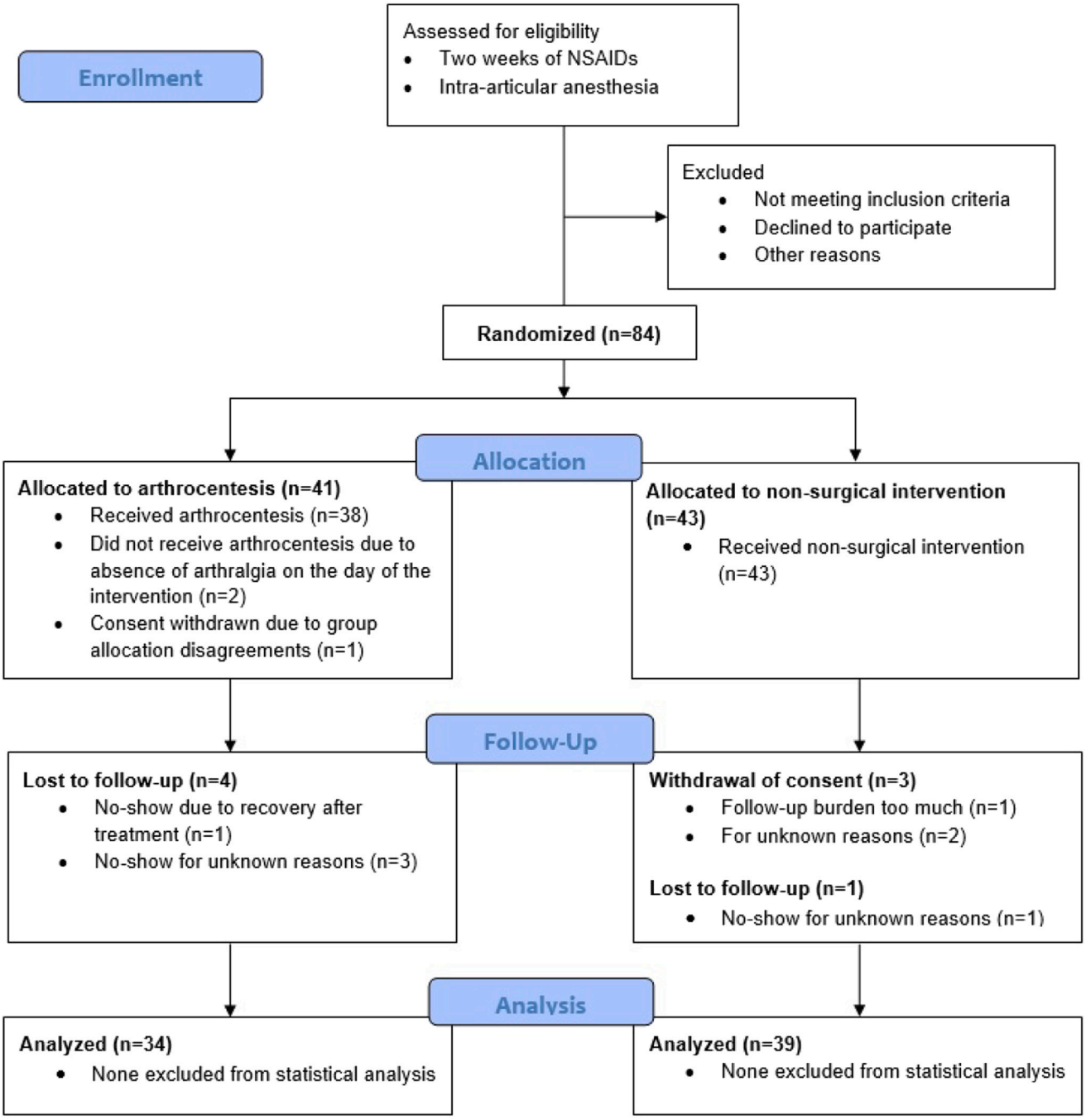

Fig. 1. CONSORT flow diagram (version 2010) of subject enrolment, allocation, and follow-up. In the arthrocentesis group, two patients did not receive treatment due to the absence of arthralgia on the day of the intervention. These two patients did not meet the inclusion criteria in the first place and were therefore mistakenly randomized. The outcome measurements of the patients in both groups who were excluded after treatment were not registered at any of the follow-up moments, rendering linear mixed model analyses of these subjects impossible.

during long-term follow-up (≥5 years). In addition to the previous report,[8] where promising results were reported for the 6-month follow-up, the findings of the present study demonstrate that arthrocentesis as the initial treatment is more efficacious in reducing TMJ arthralgia over a period of ≥ 5 years than conservative, non-surgical intervention.

LMM analyses in this study allowed the accurate longitudinal evaluation of treatment efficacy. Results from these analyses are a better representation of treatment efficacy than results from comparing solely the outcome variables of the individual follow-up moments (Fig. 2; Table 2). This is because the LMM allowed the inclusion of the time of latest follow-up (which differed between subjects) and the baseline scores as predictors in the statistical model. Comparison of the outcome variables at the latest follow-up, however, showed a smaller spread in the arthrocentesis group, indicating a more predictable treatment outcome compared to NS (Table 2).

Table 1. Baseline characteristics of the study population after randomization, and the final study sample.

Predictors	After randomization		Final study sample	
	Arthrocentesis	Non-surgical intervention	Arthrocentesis	Non-surgical intervention
Sample size, *n*	41	43	34	39
Female/male, *n* (%)	30 (73)/11 (27)	34 (79)/9 (21)	25 (74)/9 (26)	32 (82)/7 (18)
Age in years, median (IQR)	28 (23–55)	31 (21–49)	27 (23–50)	29 (21–41)
VASm (mm), mean (SD)	51.60 (18.88)	54.80 (24.46)	53.16 (17.82)	54.45 (23.96)
VASr (mm), median (IQR)	15.00 (00.0–34.00)	17.00 (0.00–44.75)	17.50 (0.00–34.75)	17.00 (0.00–44.25)
MFIQ, mean (SD)	49.43 (14.51)	47.79 (19.10)	49.16 (14.79)	48.98 (18.10)
ID, *n* (%)				
No ID	6 (16)	6 (14)	6 (18)	6 (15)
ADDwR	9 (24)	12 (29)	8 (24)	11 (28)
ADDwR with intermittent locking	11 (29)	10 (24)	10 (29)	9 (23)
ADDwoR with limited mouth opening	12 (32)	13 (31)	10 (29)	12 (31)
ADDwoR without limited mouth opening	0 (0)	1 (2)	0 (0)	1 (3)
ID, missing[a]	3	1	0	0
DJD, *n* (%)				
No DJD	19 (48)	24 (57)	16 (47)	22 (56)
Indeterminate for DJD	12 (30)	10 (24)	9 (26)	9 (23)
Evidence of DJD	9 (23)	8 (19)	9 (26)	8 (21)
DJD, missing[a]	1	1	0	0

ADDwR, anterior disc displacement with reduction; ADDwoR, anterior disc displacement without reduction; DJD, degenerative joint disease; ID, internal derangement; IQR, interquartile range (Q1–Q3); MFIQ, mandibular function impairment questionnaire; SD, standard deviation; VASm, visual analogue scale during mandibular movement (and/or function); VASr, visual analogue scale at rest.
[a]Missing indicates unregistered diagnoses of the drop-outs. The missing subjects are not included in the percentages.

The study findings support current evidence that arthrocentesis may be beneficial for patients with ID and/or DJD.[19,20] More importantly, the timing of arthrocentesis is paramount to optimize the treatment outcome. Performing interventions as soon as possible enhances the immediate joint recovery process. The response to arthrocentesis is more evident in acute cases of TMJ arthralgia compared to chronic ones.[21] However, traditional conservative care encompasses a prolonged treatment period, putting patients more at risk of developing chronic pain in the event that those treatment methods are insufficient in reducing symptoms. Therefore, a reconsideration of the current therapeutic strategies in favour of arthrocentesis could potentially be beneficial for patients.

The important role of performing minimally invasive treatment procedures early is supported by a recent systematic review, in which the authors concluded that such procedures are more beneficial than conservative care in the short term (≤5 months) and intermediate term (6 months–4 years).[22] The current study provides further evidence that arthrocentesis is superior in improving patient-reported outcomes in the long term. On the other hand, another recent systematic review investigating the influence of the timing of arthrocentesis on patient outcomes, in relation to conservative care, concluded that in addition to the favourable outcomes of arthrocentesis in general, the optimal results were obtained when arthrocentesis was performed within 3 months after conservative care.[23] The authors noted, however, that the evidence was of low to moderate quality due to the low availability of well-designed studies and the heterogeneity between studies in diagnoses, treatment modalities, and techniques used. Definitive conclusions regarding the optimal timing of arthrocentesis may be drawn once different timings are compared in a single clinical trial in the future.

Interestingly, mandibular function, expressed as the MFIQ score, did not differ significantly between the two treatment groups in the specific study model. Seemingly, the patients who underwent arthrocentesis did not experience an improvement in performing daily activities related to their jaw compared to the patients who received NS, despite having less pain. It is hypothesized that factors other than pain may also play a role in the patients' perception of mandibular function, such as mouth opening restrictions due to mechanical obstructions, or the psychosocial profile (i.e., pain-avoiding behaviour and fear).

Additional treatment during the follow-up was not associated with better treatment outcomes in the full multivariable model. Remarkably, 10 (26%) patients who were allocated to the NS group required additional treatment, six of whose outcome measurements were recorded afterwards, whereas only two (6%) patients allocated to the arthrocentesis group received additional treatment. These findings are in line with the results of Tatli et al.,[24] who reported the superiority of arthrocentesis over splint therapy after 6 months for the treatment of anterior disc displacement (ADD) without reduction (success rate of 93% for arthrocentesis versus 60% for splint therapy).

Neither age nor sex was associated with the degree of TMJ arthralgia or functional impairment in the current full multivariable model. Furthermore, the degree of DJD seen on radiographic imaging was not significantly associated with TMJ arthralgia, which is consistent with previous findings.[25,26] This is because observed radiographic changes in bony structures may have also been the result of remodelling in the context of joint recuperation,

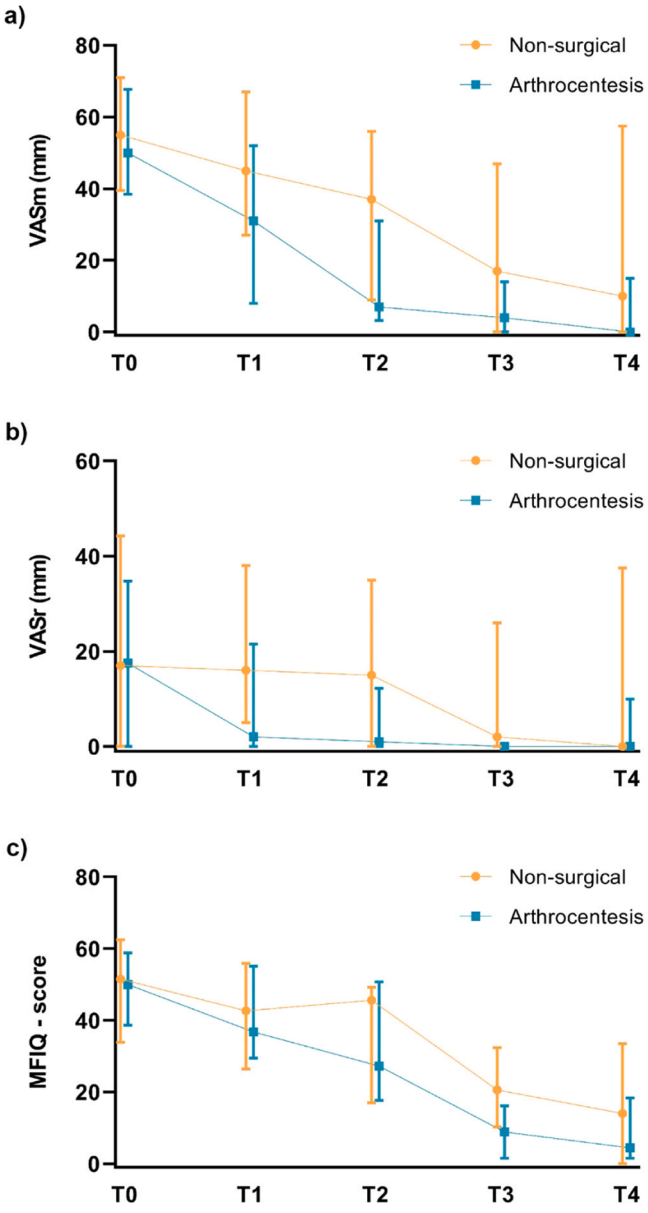

Fig. 2. Progression of (a) pain during movement (VASm), (b) pain at rest (VASr), and (c) perceived mandibular function (MFIQ score) over time for non-surgical intervention and arthrocentesis. The graphs are based on the raw data (not the linear mixed models), presented as the median and interquartile range error bars.VASm, visual analogue scale during mandibular movement (and/or function); VASr, visual analogue scale at rest; MFIQ, mandibular function impairment questionnaire; T0, baseline; T1, 3-week follow-up; T2, 12-week follow-up; T3, 26-week follow-up; T4, ≥ 5-year follow-up.

indicating a return to a homeostatic state of the articular structures.[4] The presence of ID was not statistically associated with TMJ arthralgia in the multivariable model, which is also consistent with the literature.[27]

The main strength of this study is that it is one of only a few randomized controlled trials that have been performed on the efficacy of arthrocentesis compared to non-surgical intervention, specifically with a long-term follow-up. Other strengths of the study include a thorough study design, using the intra-articular injection procedure as a diagnostic tool, and the relatively large number of study patients. Furthermore, appropriate statistical models for longitudinal analyses were constructed.

This study has some limitations. No magnetic resonance imaging (MRI) scans were performed, which may have affected the diagnostic testing of ID. According to the DC/TMD,[15] definitive diagnosis of ID, with the exception of ADD without reduction with limited mouth opening, requires an MRI to achieve adequate diagnostic sensitivity (i.e., ≥70%) and specificity (i.e., ≥95%). However, the participants were included in this study several years before the general consensus regarding optimal diagnostic testing using imaging was described in the current DC/TMD. More importantly, an MRI-confirmed displaced disc is not exclusive to a pathological condition; it is present in approximately 30% of asymptomatic patients[4] and does not influence the treatment choice or outcome.[28,29] In the present study, the psychosocial profiles of the study patients over time were not recorded. This could have distorted the results, since psychosocial factors are known to be associated with temporomandibular pain.[27,30] However, due to the duration of follow-up, answering additional extensive questionnaires on the phone many years post-treatment could have resulted in an excessive burden for the study participants.

Table 2. Results of the study outcomes recorded at the latest follow-up (T4, ≥5 years).

Study outcome	Treatment group		*P*-value
	Arthrocentesis	Non-surgical intervention	
VASm (mm), median (IQR)	0.00 (0.00–15.00)	10.00 (0.00–57.5)	0.097
VASr (mm), median (IQR)	0.00 (0.00–10.00)	0.00 (0.00–37.5)	0.154
MFIQ, median (IQR)	4.41 (1.47–18.38)	13.97 (0.00–33.46)	0.360

IQR, interquartile range (Q1–Q3); MFIQ, mandibular function impairment questionnaire; VASm, visual analogue scale during mandibular movement (and/or function); VASr, visual analogue scale at rest.

Table 3. Simple and full multivariable linear mixed model analyses results.

Predictors	VASm		VASr		MFIQ	
	β (95% CI)	*P*-value	β (95% CI)	*P*-value	β (95% CI)	*P*-value
Simple multivariable						
Treatment (Ref. = non-surgical)	−11.13 (−20.04; −2.21)	0.014	−8.72 (−16.23; −1.21)	0.023	−3.89 (−11.16; 3.37)	0.293
Follow-up in weeks	−0.07 (−0.09; −0.04)	<0.001	−0.02 (−0.04; −0.00)	0.023	−0.08 (−0.10; −0.06)	<0.001
Full multivariable						
Treatment (Ref. = non-surgical)	−10.23 (−17.86; −2.60)	0.009	−8.39 (−13.70; −3.08)	0.002	−2.41 (−8.61; 3.78)	0.445
Follow-up in weeks	−0.07 (−0.09; −0.05)	<0.001	−0.02 (−0.03; 0.00)	0.063	−0.09 (−0.11; −0.07)	<0.001
Baseline score (in millimetres for VASm and VASr)	0.58 (0.39; 0.77)	<0.001	0.56 (0.45; 0.67)	<0.001	0.57 (0.37; 0.76)	<0.001
Sex (Ref. = female)	−0.68 (−10.42; 9.06)	0.891	−3.30 (−9.93; 3.33)	0.330	−2.05 (−9.83; 5.72)	0.605
Age in years	0.02 (−0.26; 0.30)	0.884	−0.00 (−0.19; 0.18)	0.975	−0.05 (−0.26; 0.17)	0.678
Additional treatment in non-surgical group[a]	6.77 (−10.71; 24.26)	0.448	−10.88 (−22.99; 1.23)	0.078	11.02 (−2.81; 24.86)	0.118
Additional treatment in arthrocentesis group[b]	−1.45 (−28.95; 26.06)	0.918	−2.15 (−21.12; 16.82)	0.824	−11.48 (−47.73; 24.76)	0.535
No ID (Ref.)	0	0.133	0	0.170	0	0.261
ADDwR	−14.28 (−26.28; −2.27)		−9.76 (−18.20; −1.33)		−6.91 (−16.39; 2.57)	
ADDwR with intermittent locking	−10.93 (−23.29; 1.43)		−4.76 (−13.43; 3.90)		−6.17 (−15.55; 3.20)	
ADDwoR with limited mouth opening	−6.90 (−18.44; 4.65)		−4.53 (−12.43; 3.37)		−1.74 (−10.72; 7.25)	
ADDwoR without limited mouth opening	−19.49 (−61.23; 22.25)		−13.07 (−41.60; 15.47)		NA	
No DJD (Ref.)	0	0.547	0	0.769	0	0.785
Indeterminate for DJD	−4.62 (−13.68; 4.44)		0.77 (−5.47; 7.02)		−2.34 (−9.42; 4.75)	
Evidence of DJD	−0.65 (−10.30; 9.01)		−1.57 (−8.13; 5.00)		−1.09 (−9.33; 7.15)	

ADDwR, anterior disc displacement with reduction; ADDwoR, anterior disc displacement without reduction; β, regression coefficient; CI, confidence interval; DJD, degenerative joint disease; ID, internal derangement; MFIQ, mandibular function impairment questionnaire; NA, not available; VASm, visual analogue scale during mandibular movement (and/or function); VASr, visual analogue scale at rest.

[a]Additional treatment in the conservative, non-surgical intervention group with arthrocentesis during the follow-up ($n = 6$).

[b]Additional treatment in the arthrocentesis group during the follow-up ($n = 2$).

Furthermore, the trial may be limited in its generalizability to other clinics and general populations with temporomandibular disorders. Patient inclusion through a diagnostic intra-articular injection allowed the accurate selection of patients suffering from pain that primarily originated from the joint.[13] However, since many patients often experience myogenous symptoms concurrently with arthralgia, some arthralgia patients with more prominent myogenous symptoms may have been excluded from the study. Moreover, in the non-surgical intervention group, any additional physical or splinting therapy was given based on the response to the initial soft diet advice, which resulted in treatment heterogeneity within the control group. The authors chose to design the study in such a manner, as this is believed to be an accurate representation of the clinical reality, where conservative therapies are mostly patient-tailored and given based on clinical presentation.

In conclusion, arthrocentesis was found to be more efficacious as an initial treatment in reducing TMJ arthralgia than non-surgical intervention over follow-up of ≥ 5 years, although mandibular function was similar after both treatments. Performing arthrocentesis at an earlier stage to treat TMJ arthralgia allows immediate initiation of joint recuperation, which is sustained over the long term. Verification of the current study results is mandatory to substantiate this conclusion.

Ethical approval

Approval to conduct this study was given by the Institutional Review Board of UMCG (METc 2008/197).

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Competing interests

None.

Patient consent

Signed informed consent was obtained from all study patients prior to the commencement of any study-related procedures.

Trial registration

This trial is registered in the Netherlands Trial Register (NL1444).

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.ijom.2022.08.018.

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Correspondence to: Department of Oral and Maxillofacial Surgery
University Medical Center Groningen
PO Box 30.001
9700 RB Groningen
the Netherlands Fax: +31 50 361 12831.
E-mail: f.k.l.spijkervet@umcg.nl