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Comparison of clinical outcomes of treatment of dysfunction of the temporomandibular joint between conventional and ultrasound-guided arthrocentesis

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Abstract

Patients with disorders of the temporomandibular joint (TMJ) who do not respond to non-operative treatment may require invasive procedures such as arthrocentesis and arthroscopy. We divided 80 patients with dysfunction of the TMJ into two groups: a control group who were treated by conventional arthrocentesis, and an experimental group who were treated by ultrasound-guided arthrocentesis. Both groups were monitored three days, one week, and one month postoperatively and the clinical outcomes compared. The experimental group had a significant reduction in the degree of pain in the immediate postoperative period ($p = 0.015$). However, ultrasound-guided arthrocentesis showed no significant improvement in symptoms overall compared with conventional arthrocentesis. Both techniques seem to be effective in the management of dysfunction of the TMJ.

Keywords: Temporomandibular joint dysfunction; internal derangement; arthrocentesis; ultrasound guided arthrocentesis

Introduction

Arthrocentesis of the temporomandibular joint (TMJ) can be done both conventionally and with ultrasound guidance. However, conventional techniques require experience and carry a risk of damage to collateral ligaments of the disc and adjacent soft tissue, whereas ultrasound-guided arthrocentesis enables correct siting and positioning of the angulation and depth of the needle. We have compared the improvements in mouth opening and the amount of pain on movement of the jaw on the third day, at one week, and one month postoperatively (using a visual analogue scale (VAS)), after ultrasound-guided and conventional arthrocentesis.

Conservative management is the first treatment for internal derangement of TMJ,[1,2] and it has been reported that up to a quarter of the entire population have internal derangements of the TMJ, which are initially treated conservatively.[3] Arthrocentesis is an easy, minimally-invasive, and highly efficient way to decrease pain in the joint and increase the range of mouth opening in patients with closed lock of the TMJ, and Nitzan et al described arthrocentesis of the TMJ as the simplest form of treating such dysfunction, as it releases the articular disc and removes adhesions between the disc and the fossa by hydraulic pressure from irrigation of the upper chamber of TMJ.[4] Considerable improvements in pain and

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Table 1
Comparison of mouth opening and pain scores between the two groups. Data are mean (SD).

Variable	Control group	Experimental group	p value
Mouth opening (mm):			
Preoperative	25.1 (5.5)	22.4 (4.3)	0.017
Postoperative:day 3	31.0 (5.55)	32.3 (4.92)	0.271
Postoperative: 1 week	34.5 (6.06)	36.1 (5.61)	0.224
Postoperative: 1 month	35.4 (7.95)	38.4 (3.43)	0.031
VAS:			
Preoperative	5.1 (0.84)	5.4 (0.93)	0.166
Postoperative: day 3	4.3 (1.44)	3.5 (1.3)	0.015
Postoperative: 1 week	3.3 (1.81)	2.8 (1.42)	0.514
Postoperative: 1 month	2.4 (1.93)	2.2 (1.42)	0.664
Age (years)	33 (14)	38 (14)	1.625

VAS = visual analogue score.

mouth opening have been reported with confirmed long-term results after arthrocentesis.[5]

Reference points must be laid down in the upper joint space for proper placement of needles for successful lysis and lavage.[4] However, use of this "blind" technique to reach the upper joint space requires experience, and carries a risk of damage to the collateral ligaments and the adjacent soft tissue. Ultrasound (US) scanning is an effective way to guide the placement of the needle, even though magnetic resonance imaging (MRI) is the gold standard for diagnosis of internal derangement of the TMJ.[6] US aids the surgeon in locating the upper compartment, and thereby enables proper placement of the needle at the correct angulation and depth for arthrocentesis.

Patients and methods

We studied a total of 80 patients with internal derangement of the TMJ who attended the outpatient clinic of the Oral and Maxillofacial Surgical Department at the Government Dental College from January 2015 to October 2017. The Ethics Committee approved the investigation and informed written consent was taken from each patient.

Patients were randomly allocated to the control group (who had conventional arthrocentesis) and the experimental group (who had ultrasound-guided arthrocentesis). There were 72 female patients and only eight men, and their ages are shown in Table 1.

Forty of the 80 patients had previously been treated with drugs and occlusal soft splints, 20 had had prosthetic rehabilitation and drug treatment, 16 had had drugs alone, and four patients had had orthodontic correction.

Inclusion and exclusion criteria

Patients were included in the study if they had internal derangement that failed to respond to conservative treatment, together with unilateral or bilateral pain in the TMJ or restricted mouth opening or closing.

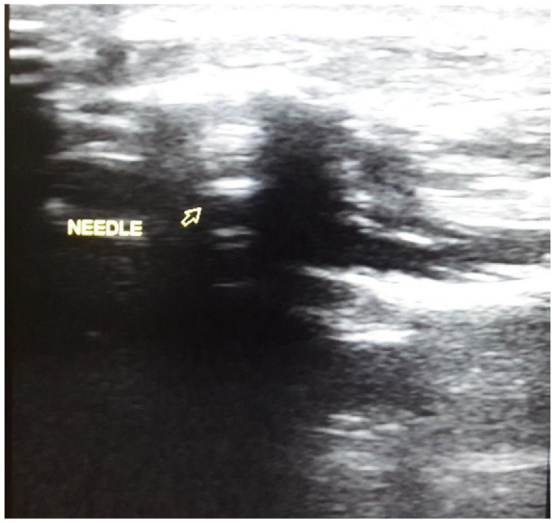

Fig. 1. Ultrasound image of the needle tip in the temporomandibular joint space.

They were excluded if they had a recent history of trauma to the maxillofacial region or a previous history of operation on the TMJ.

Surgical techniques

Both operations were done under local anaesthesia, and ultrasound was done by the same surgeon with the help of a radiologist. The accuracy of placement of the needle in conventional TMJ arthrocentesis was calculated by the technique described by Nitzan et al.[4] A line was drawn from the midtragal point to the lateral canthus of the eye (Holmlund – Hellsing line). Point A was marked 10 mm anterior and 2 mm inferior to that line. This served as the point of entry of the first needle into the upper joint space. Point B was marked a further 10 mm anterior to the first point, and 10 mm inferior to the line. This served as the point of entry of the second needle.

Ultrasound-guided arthrocentesis of the temporomandibular joint: the puncture points of the needle were visualised ultrasonographically. A sterile US probe was placed over the TMJ perpendicular to the zygomatic arch and parallel to the mandibular ramus, and tilted until visualisation was optimal. A 19G needle was first used to puncture the skin in front of the tragus, followed by advancement of the US-guided needle into the glenoid fossa (Fig. 1). After the needle had entered the upper joint space, which was inflated, Ringer's lactate 0.1–0.2 ml was injected under random pressure with direct vision of the expanding joint cavity to confirm the site of the needle. When the expansion of the joint cavity was evident, Ringer's lactate 2 ml was injected to distend the upper joint space. A second 19G needle was inserted in the region of the articular eminence under US guidance, and then the joint cavity was irrigated with Ringer's lactate 300 ml under random pressure. After lavage, both needles were removed and a pressure dressing applied. Patients were advised to do regular active mouth-opening

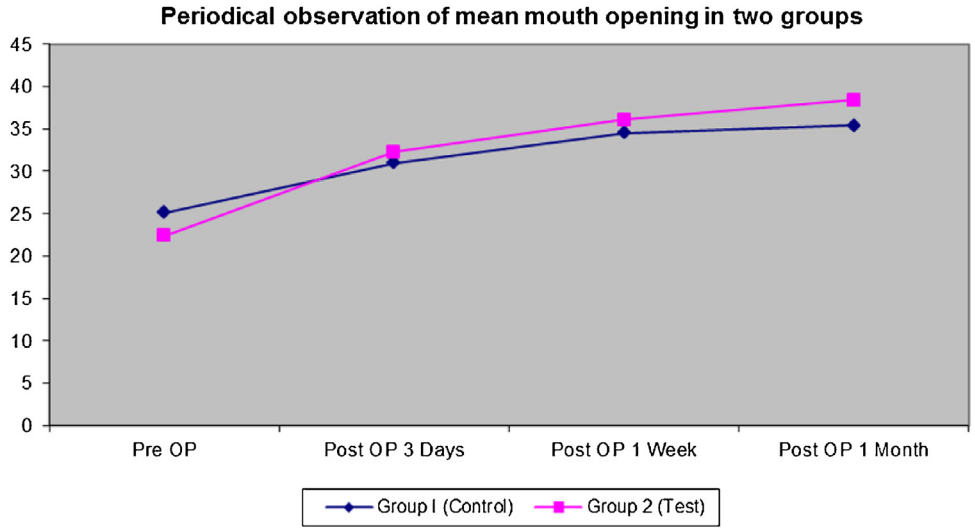

Fig. 2. Interincisal distance during follow up in the two groups.

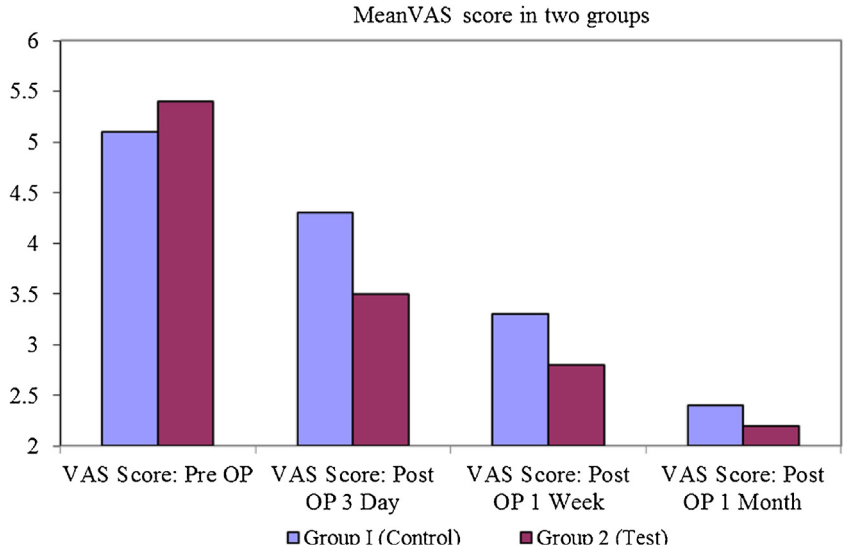

Fig. 3. VAS scores in the two groups.

exercises, and to use ibuprofen 400 mg as required for pain relief. Lower 1 mm soft bite splints were worn during the day.

Differences in mouth opening (interincisal distance) were measured before and after operation by the same surgeon using a centimetre scale. Pain scores were also recorded before and after operation using a 10 cm visual analogue scale (VAS).

Statistical analysis

Statistical analysis was done with the aid of IBM SPSS Statistics for Windows (version 20, IBM Corp). Data were entered into Microsoft Excel. The Mann Whitney U test was used to analyse the significance of differences in mouth opening and pain scores between the groups.

Results

The needle was accurately placed in the joint cavity in the control group using the conventional technique. In US-guided arthrocentesis the puncture points were visualised ultrasonographically.

The degree of mouth opening (interincisal distance) and VAS score of TMJ pain had improved significantly in both the groups (Table 1). Fig. 2 shows the comparison of the interincisal distances in the two groups.

The VAS score reduced during the days after the procedure in both groups, and differed significantly at all the three follow up periods compared with the preoperative measurements (Fig. 3). There was no significant difference in age between the two groups.

Discussion

Clinical outcomes had improved after the procedure in both the groups but neither group had a significantly better outcome than the other. Matsumoto et al compared a cone-beam computed tomography (CT) image-guided puncture technique with the conventional technique for accuracy in placing the needle, and reported that the image-guided technique was significantly more accurate than the conventional technique.[7]

Fritz et al used MRI to guide injections into the TMJ and the mean (range) duration of the procedure was 25 (16–53) minutes.[8] However, this may not always be an option as MRI is expensive and cumbersome compared with US, which is relatively inexpensive, does not expose the patient to radiation (as cone-beam CT does), and yields real-time images that permit dynamic assessment. The devices are portable and mobile, which allows evaluation of both joints. Sibbitt et al reported that US-guided arthrocentesis caused significantly less pain during the operation.[9]

In 2003 Raza et al marked the proximal interphalangeal or metacarpophalangeal joint as the site of injection,[10] and compared US-guided with palpation-guided placement of the needle in terms of the accuracy of intra-articular placement of the needle. Positioning of the needle was intra-articular in 59% when guided by palpation but in 96% when guided by US. This confirms our findings of 60% success rate with intra-articular placement of the needle at the first attempt by conventional arthrocentesis, and 100% with US guidance.

Cunnington et al found that the use of an US-guided technique significantly improved the accuracy of intra-articular injections, but not the outcomes of the injections.[11] These findings also agree with ours in that the improvement in mouth opening in patients in the experimental group did not differ significantly from that in the conventional group. Patients who had US-guided arthrocentesis did not need the needle to be relocated, which could be the reason for the pronounced reduction in VAS compared with that in the control group on the third postoperative day. The number of attempts made to relocate the needle can affect postoperative outcomes.

Sivri et al also compared US-guided and conventional arthrocentesis of the TMJ.[12] Their increase in interincisal distance one month after US-guided arthrocentesis was 5.3 mm, whereas we found that interincisal distance improved by 10.3 mm in the experimental group. They reported a reduction in VAS of up to 2.3 at the one-month follow up, which is nearly equal to the VAS (2.2) in our experimental group after one month. We found that there was difficulty in positioning both patient and operator in the conventional group. At the three-day follow up there was a pronounced reduction in VAS, as repositioning of the needle was not required in ultrasound-guided cases. However after one week and one month there were no differences in outcomes between the two groups.

Of the 40 patients in the control group, the needle had to be repositioned in 16 to get proper outflow of lavage fluid, whereas it was not required in the experimental group as placement of the needle was perfect. We also found that in obese patients US-guided arthrocentesis was more accurate in locating the articular space, whereas conventional arthrocentesis needed multiple punctures to get successful lavage. Postoperative mouth opening (interincisal distance) had improved at all three follow-up periods, and remained significant in both groups.

Both the groups also had significant reductions in VAS during the postoperative period, and on the third day it was reduced significantly in the experimental compared with the control group, though not at one week and one month.

The limitations of this study are that it was a short-term follow-up study with relatively small groups, but the benefit of US-guided arthrocentesis seems to be related mainly to a reduction in the numbers of needle punctures required to access the joint adequately.

Ethics statement/confirmation of patients' permission

Ethics approval and patients' permission were obtained.

Conflict of interest

We have no conflicts of interest.

References

1. Chung SC, Kim HS. The effect of the stabilization splint on the TMJ closed lock. *Cranio* 1993;**11**:95–101.
2. Mongini F, Ibertis F, Manfredi A. Long-term results in patients with disk displacement without reduction treated conservatively. *Cranio* 1996;**14**:301–5.
3. Yura S, Totsuka Y. Relationship between effectiveness of arthrocentesis under sufficient pressure and conditions of the temporomandibular joint. *J Oral Maxillofac Surg* 2005;**63**:225–8.
4. Nitzan DW, Dolwick MF, Martinez GA. Temporomandibular joint arthrocentesis: a simplified treatment for severe, limited mouth opening. *J Oral Maxillofac Surg* 1991;**49**:1163–7.
5. Nishimura M, Segami N, Kaneyama K, et al. Prognostic factors in arthrocentesis of the temporomandibular joint: Evaluation of 100 patients with internal derangement. *J Oral Maxillofac Surg* 2001;**59**:874–7.
6. Dayisoylu EH, Cifci E, Uckan S. Ultrasound-guided arthrocentesis of the temporomandibular joint. *Br J Oral Maxillofac Surg* 2013;**51**:667–8.
7. Matsumoto K, Bjornland T, Kai Y, et al. An image-guided technique for puncture of the superior temporomandibular joint cavity: clinical comparison with the conventional puncture technique. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2011;**111**:641–8.
8. Fritz J, Thomas C, Tzaribachev N, et al. MRI-guided injection procedures of the temporomandibular joints in children and adults: Technique, accuracy, and safety. *AJR Am J Roentgenol* 2009;**193**:1148–54.
9. Sibbitt Jr WL, Kettwich LG, Band PA, et al. Does ultrasound guidance improve the outcomes of arthrocentesis and corticosteroid injectionof the knee? *Scand J Rheumatol* 2012;**41**:66–72.

10. Raza K, Lee CY, Pilling D, et al. Ultrasound guidance allows accurate needle placement and aspiration from small joints in patients with early inflammatory arthritis. *Rheumatology (Oxford)* 2003;**42**:976–9.
11. Cunnington J, Marshall N, Hide G, et al. A randomized, double-blind, controlled study of ultrasound-guided corticosteroid injection into the joint of patients with inflammatory arthritis. *J Arthritis Rheum* 2010;**62**:1862–9.
12. Sivri MB, Ozkan Y, Filiz Pekiner FN, et al. Comparison of ultrasound-guided and conventionalarthrocentesis of the temporomandibular joint. *Br J Oral Maxillofac Surg* 2016;**54**:677–81.