

A literature review of temporomandibular joint arthrocentesis: start to success

Jittima Pumklin^{1*}

1. Department of Restorative Dentistry, Faculty of Dentistry, Naresuan University, Phitsanulok, Thailand.

Abstract

Temporomandibular disorder (TMD) is a term that encompasses pain and dysfunction of masticatory muscles, temporomandibular joint (TMJ), and all associated tissues. The most common form of TMD is internal derangement. Patients normally undergo conservative treatments followed by a surgical procedure if necessary. Arthrocentesis is a minimal invasive and highly effective treatment that is frequently used to treat internal derangement. This technique aims to wash inflammatory cytokines, release intraarticular pressure, promote disc reposition and break adhesion of TMJ. It is a simple, feasible, inexpensive procedure and has less complications. The objective of this paper is to review current evidences of TMJ arthrocentesis including objectives, indications, techniques and procedures, complications, success rate as well as prognosis.

Clinical article (J Int Dent Med Res 2018; 11(2): pp. 486-490)

Keywords: Temporomandibular joint, arthrocentesis, joint lavage, TMD, closed lock.

Received date: 06 March 2018

Accept date: 01 April 2018

Introduction

The temporomandibular disorder (TMD) is the second most common diagnosis of orofacial pain other than dental pain. TMD affects masticatory muscle, temporomandibular joint (TMJ) and associated tissues.¹ Pain and/or jaw dysfunction are the main complaint of patients.²⁻⁴ Internal derangement is a general orthopedic term resulting from disc displacement. Disc displacement with reduction (DDwR) is diagnosed when the articular disc can reduce to the normal position during mouth opening. On the other hand, if the disc blocks condylar translation because it cannot reduce to normal position, it is called disc displacement without reduction with limited opening (DDwoR) or closed lock.¹ The main symptoms of closed lock is limited jaw movement.

The etiology of disc displacement involves an altered disc shape and/or dynamic properties such as trauma, a steepness of articular eminence, the lateral pterygoid muscle hyperactivity, and joint hypermobility.^{5, 6} Several

evidences demonstrated that long term joint overload or estrogen deficiency in menopausal woman⁷ induced degradation of articular cartilage following impaired biomechanics, loading of retrodiscal tissues, inflammation and uncontrolled reactive oxygen species (ROS) production. This events increased intraarticular joint pressure and reduced the joint lubrication causing the disc displacement. Finally, it was proposed that closed lock was a result of stiffness between the articular disc and the superior joint cavity of TMJ.⁸⁻¹⁰

The treatment of TMD is complicated and requires specific knowledge. Conservative procedures including self-management, pharmacotherapy, occlusal splint, exercise and/or massage are recommended. Numerous conservative interventions have been used for closed lock management, but they are not always success.¹¹⁻¹⁴ Arthrocentesis is bordering between conservative and surgical treatment. It is a minimally invasive procedure for patients suffering from internal derangement especially closed lock. The success rate of arthrocentesis used to treat internal derangement is higher than that of conservative treatment.¹⁴ Moreover, the arthrocentesis is the simplest form of surgical intervention with virtually no complications. The aim of this paper is to review the current literature of TMJ arthrocentesis including objectives, indications, techniques and procedures, complications, success rate and prognosis.

*Corresponding author:

Jittima Pumklin
Department of Restorative Dentistry,
Faculty of Dentistry, Naresuan University,
Phitsanulok, Thailand
E-mail: Jittimap@nu.ac.th

Historical

The synovial fluid has been identified in rheumatoid arthritis since the *Hippocratic Corpus* period. In 1592, Dr. Frey Augustin Farfan explained the technique and benefit of the knee arthrocentesis in his textbook. In 1560-1634, Dr. Fabricius Hildanus is the first surgeon that treated the knee joint by puncture. However, no evidence of therapeutic punctures in knee joint until Jean Gay published his work in 1792.¹⁵

TMJ arthrocentesis was developed after casual events in TMJ arthrography. Patients who underwent TMJ arthrography, where the contrast dye was injected for purpose of TMJ imaging, experienced improved pain and jaw movement after the dye was washed out.¹⁶ Moreover, unlike TMJ arthroscopy, the use of microscope to visualize the joint is not necessary because of the limited space of TMJ.¹⁷ As a consequence, TMJ arthrocentesis was first introduced in 1991 by Dr. Nitzan.¹⁸

The objective and mechanism of action

The main objective of TMJ arthrocentesis is to release the disc adhesion and relieve the pain. The mechanical stress or friction of the joint is believed to cause internal derangement or disc adhesion. Thus, TMJ lavage aims to eliminate the vacuum effect, break the disc adhesion, and decrease intraarticular pressure and viscosity of synovial fluid.^{19, 20} Moreover, the arthrocentesis directly washes out the inflammatory cytokines²¹ following medication injection into the TMJ at the last step. This medication is affected to increase joint lubrication and pain reduction.²²⁻²⁴

The indications

Currently, TMJ arthrocentesis is not indicated only for acute disc displacement without reduction (Closed lock) but it is also recommended for various TMD conditions including²⁵⁻²⁹: 1) internal derangement's patients who fail from conservative treatment, 2) limited mouth opening caused by internal derangement or adherence/adhesion, 3) disc displacement with/without reduction, 4) chronic joint pain or TMJ arthralgia/arthritis, and 5) degenerative joint disease.

The technique and procedure

Presently, several techniques of TMJ arthrocentesis has been proposed.³⁰⁻³³ For example, Guarda-Nardini et al.³¹ first described a one-needle technique. They suggested that the one-needle technique is practical, easy to stabilize access to the superior joint space, minimal trauma, reduced complications and postoperative pain. Nevertheless, the most common procedure is the two-needle technique^{17, 24, 28, 34} that will be discussed in this review.

Patient sits in semi-supine position on the dental chair and turns their head to the unaffected side. The operation area is disinfected with povidone-iodine and 70% alcohol, respectively. The external auditory canal is protected with cotton roll. The landmarks for the first and second needle are drawn. The straight line is drawn on the skin from midpoint of the ear tragus to the lateral of the eye canthus (The Holmlund-Hellsing line)³⁵. The first point (A) which indicates the location of the articular fossa is marked 10 mm. anterior to the midpoint of the ear tragus and 2 mm. inferior along the Holmlund-Hellsing line. The second point (B) which represents the articular eminence is marked 10 mm. anterior to the A point and 10 mm below the Holmlund-Hellsing line (Figure 1). The auriculotemporal nerve and surrounding tissue of the marked area is anesthetized. The patient is instructed to open the mouth and move to the opposite side during procedure.

An 18 to 20-gauge needle is inserted superiorly and anteriorly into the superior joint cavity through A point until it contacts the zygomatic arch. Then, the needle is drawback inferiorly until its tip is in the superior joint cavity. The distance from skin to the superior joint cavity center is approximately 25 mm.³⁶ Two milliliter of the ringer's lactate solution or normal saline is injected to expand the joint cavity. After that, the second needle is introduced posteriorly and superiorly to the superior joint cavity through B point (Figure 2).

Ideally, 300-400 ml of ringer's solution or normal saline is used to lavage from the first needle and outflow through the second one. These volumes have proven to be sufficiently eliminate the degraded proteins and inflammatory components from the joint cavity.²¹ Yura et al.^{19, 20} reported that inadequate pressure

was not able to distend the joint cavity and encourage the normal reposition of the disc. Fourty kPa is a recommended pressure that can enhance the success rate of TMJ arthrocentesis. In the final step, the second needle is removed and medical substances such as corticosteroid³⁷⁻³⁹, sodium hyaluronate (SH)^{24, 40} morphine^{23, 41} or non-steroidal anti-inflammatory drugs (NSAIDs)^{42, 43} are injected into the joint.

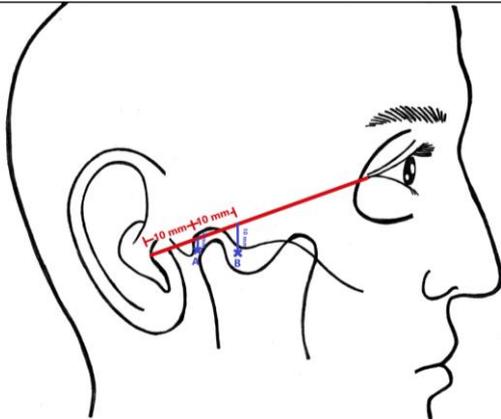


Figure 1. The two-needle technique anatomical landmark for TMJ arthrocentesis. The red line represents the Holmlund-Helsing line. A point represents for the first needle which indicates the location of the articular fossa and B point represents for the second one which indicates the articular eminence.



Figure 2. Clinical photograph of patient during TMJ arthrocentesis procedure.

After completion of joint lavage, a patient is instructed to exercise the jaw in any positions and avoid the hard or sticky diet in first week after procedure. Moist heat compression is

recommended for 1 week. Postoperative medications are prescribed such as NSAIDs and a muscle relaxant. The follow up visit is scheduled after 1 day, 1 week, 4 weeks, 3 months and 6 months later.

The complications

Even though arthrocentesis is a safe procedure, the complications of this technique depend on the anatomy of the TMJ and related structures, skill of operators and the technique used. The complications include extravasation of the fluid around the operation field, nerve injury especially facial nerve, trauma to the TMJ structure, preauricular hematoma, transarticular or intracranial perforation, extradural hematoma, unsuccessful induction of the needle and broken needle tip which ranges between 2-10%.^{17, 28, 34, 44, 45}

The success rate and prognosis

The overall success rate of TMJ arthrocentesis is estimated to be 70-95%.^{14, 46-48} Murakami et al.¹⁴ compared the success rate of each management of TMJ closed lock. They concluded that the success rates of conservative treatment, arthrocentesis and arthroscopy were 55.6%, 70% and 91%, respectively. Kuruvilla et al.⁴⁷ reported that arthrocentesis reduced pain 91%, improved mouth opening 91%, decreased clicking 66% and crepitation 91%. The success rate and prognosis of arthrocentesis depend on numerous factors such as case selection, professional experience, chronicity of symptoms and follow up time. Although age did not significantly affect the outcome of arthrocentesis, the older patients normally reveal slower recovery. The duration of symptoms is an important factor. The chronic patients showed reduced the therapeutic effect of arthrocentesis compare to that of acute patients.^{46, 48} Patients with oral habits such as clenching or bruxism showed lower success rate than the normal one. Gender and diagnosis had no effect on success rate.⁴⁸

Conclusions

Occasionally, TMD is not recovery by conservative treatment. TMJ arthrocentesis is a procedure that is minimally invasive, simple, high

success rate and rare complications. However, the therapeutic effect of arthrocentesis depends on several factors. TMJ arthrocentesis is an alternative strategy to use for TMD management specifically for unsuccessful conservative treatment.

References

1. Peck CC, Goulet JP, Lobbezoo F, et al. Expanding the taxonomy of the diagnostic criteria for temporomandibular disorders. *J Oral Rehabil* 2014;41(1):2-23.
2. Luz JG, Maragno IC, Martin MC. Characteristics of chief complaints of patients with temporomandibular disorders in a Brazilian population. *J Oral Rehabil* 1997;24(3):240-3.
3. Nassif NJ, Al-Salleeh F, Al-Admawi M. The prevalence and treatment needs of symptoms and signs of temporomandibular disorders among young adult males. *J Oral Rehabil* 2003;30(9):944-50.
4. Agacayak KS, Kose I, Gulsun B, et al. Temporomandibular joint (TMJ) dislocation during intubation and dental procedures. *J Int Dent Med Res* 2012;5(3):165-8.
5. Manfredini D. Etiopathogenesis of disk displacement of the temporomandibular joint: a review of the mechanisms. *Indian J Dent Res* 2009;20(2):212-21.
6. Ogren M, Faltmars C, Lund B, Holmlund A. Hypermobility and trauma as etiologic factors in patients with disc derangements of the temporomandibular joint. *Int J Oral Maxillofac Surg* 2012;41(9):1046-50.
7. Azhari, Sitam S, Hidajat NN, Arifin AZ. Panoramic radiograph analysis of trabeculae, cortical, and radius of condyle head in post menopausal women. *J Int Dent Med Res* 2017;10:145-50.
8. Nitzan DW. The process of lubrication impairment and its involvement in temporomandibular joint disc displacement: a theoretical concept. *J Oral Maxillofac Surg* 2001;59(1):36-45.
9. Nitzan DW, Etsion I. Adhesive force: the underlying cause of the disc anchorage to the fossa and/or eminence in the temporomandibular joint--a new concept. *Int J Oral Maxillofac Surg* 2002;31(1):94-9.
10. Israel HA. Internal Derangement of the Temporomandibular Joint: New Perspectives on an Old Problem. *Oral Maxillofac Surg Clin North Am* 2016;28(3):313-33.
11. Al-Baghdadi M, Durham J, Araujo-Soares V, et al. TMJ Disc Displacement without Reduction Management: A Systematic Review. *J Dent Res* 2014;93(7):37-51.
12. Miernik M, Wieckiewicz W. The Basic Conservative Treatment of Temporomandibular Joint Anterior Disc Displacement Without Reduction--Review. *Adv Clin Exp Med* 2015;24(4):731-5.
13. Wieckiewicz M, Boening K, Wiland P, Shiau YY, Paradowska-Stolarz A. Reported concepts for the treatment modalities and pain management of temporomandibular disorders. *J Headache Pain* 2015;16:106-17.
14. 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(3):253-7.
15. Aceves-Avila FJ, Delgado-Ruano MA, Ramos-Remus C, Gomez-Vargas A, Gutierrez-Urena S. The first descriptions of therapeutic arthrocentesis: a historical note. *Rheumatology (Oxford)* 2003;42(1):180-3.
16. Ross JB. The intracapsular therapeutic modalities in conjunction with arthrography: case reports. *J Craniomandib Disord* 1989;3(1):35-43.
17. Tozoglu S, Al-Belasy FA, Dolwick MF. A review of techniques of lysis and lavage of the TMJ. *Br J Oral Maxillofac Surg* 2011;49(4):302-9.
18. Nitzan DW, Dolwick MF, Martinez GA. Temporomandibular joint arthrocentesis: a simplified treatment for severe, limited mouth opening. *J Oral Maxillofac Surg* 1991;49(11):1163-70.
19. Yura S, Totsuka Y, Yoshikawa T, Inoue N. Can arthrocentesis release intracapsular adhesions? Arthroscopic findings before and after irrigation under sufficient hydraulic pressure. *J Oral Maxillofac Surg* 2003;61(11):1253-56.
20. Yura S, Totsuka Y. Relationship between effectiveness of arthrocentesis under sufficient pressure and conditions of the temporomandibular joint. *J Oral Maxillofac Surg* 2005;63(2):225-8.
21. Kaneyama K, Segami N, Nishimura M, et al. The ideal lavage volume for removing bradykinin, interleukin-6, and protein from the temporomandibular joint by arthrocentesis. *J Oral Maxillofac Surg* 2004;62(6):657-61.
22. Vos L, Huddleston Slater JJR, Stegenga B. Arthrocentesis as initial treatment for temporomandibular joint arthropathy: A randomized controlled trial. *J Craniomaxillofac Surg* 2014;42(5):134-9.
23. Sipahi A, Satilmis T, Basa S. Comparative study in patients with symptomatic internal derangements of the temporomandibular joint: analgesic outcomes of arthrocentesis with or without intra-articular morphine and tramadol. *Br J Oral Maxillofac Surg* 2015;53(4):316-20.
24. Gorrela H, Prameela J, Srinivas G, et al. Efficacy of Temporomandibular Joint Arthrocentesis with Sodium Hyaluronate in the Management of Temporomandibular Joint Disorders: A Prospective Randomized Control Trial. *J Maxillofac Oral Surg* 2017;16(4):479-84.
25. Monje-Gil F, Nitzan D, Gonzalez-Garcia R. Temporomandibular joint arthrocentesis. Review of the literature. *Med Oral Patol Oral Cir Bucal* 2012;17(4):575-81.
26. Reddy R, Reddy V, Reddy S, Reddy S. Arthrocentesis - A minimally invasive treatment of temporomandibular joint dysfunction: Our experience. *J NTR Univ Health Sci* 2013;2(3):196-200.
27. Bhargava D, Jain M, Deshpande A, Singh A, Jaiswal J. Temporomandibular joint arthrocentesis for internal derangement with disc displacement without reduction. *J Maxillofac Oral Surg* 2015;14(2):454-9.
28. Tvrdy P, Heinz P, Pink R. Arthrocentesis of the temporomandibular joint: a review. *Biomed Pap Med Fac Univ Palacky Olomouc Czech Repub* 2015;159(1):31-4.
29. Grossmann E. Arthrocentesis techniques applied to arthrogenic temporomandibular joint disorders. *Rev Dor.* 2012;13(4):374-81.
30. Alkan A, Bas B. The use of double-needle canula method for temporomandibular joint arthrocentesis: clinical report. *Eur J Dent* 2007;1(3):179-82.
31. Guarda-Nardini L, Manfredini D, Ferronato G. Arthrocentesis of the temporomandibular joint: a proposal for a single-needle technique. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2008;106(4):483-6.
32. Rehman KU, Hall T. Single needle arthrocentesis. *Br J Oral Maxillofac Surg* 2009;47(5):403-4.
33. Oreroglu AR, Ozkaya O, Ozturk MB, Bingol D, Akan M. Concentric-needle cannula method for single-puncture arthrocentesis in temporomandibular joint disease: an inexpensive and feasible technique. *J Oral Maxillofac Surg* 2011;69(9):2334-8.
34. Dimitroulis G, Dolwick MF, Martinez A. Temporomandibular joint arthrocentesis and lavage for the treatment of closed lock: a follow-up study. *Br J Oral Maxillofac Surg* 1995;33(1):23-7.
35. Holmlund A, Hellsing G. Arthroscopy of the temporomandibular joint. An autopsy study. *Int J Oral Surg* 1985;14(2):169-75.
36. Nitzan DW. Arthrocentesis--incentives for using this minimally invasive approach for temporomandibular disorders. *Oral Maxillofac Surg Clin North Am* 2006;18(3):311-28, vi.
37. Giraddi GB, Siddaraju A, Kumar B, Singh C. Internal derangement of temporomandibular joint: an evaluation of effect of corticosteroid injection compared with injection of sodium hyaluronate after arthrocentesis. *J Maxillofac Oral Surg* 2012;11(3):258-63.

38. Tabrizi R, Karagah T, Arabion H, Soleimanpour MR, Soleimanpour M. Outcomes of arthrocentesis for the treatment of internal derangement pain: with or without corticosteroids? *J Craniofac Surg* 2014;25(6):571-5.
39. Giraddi GB, Siddaraju A, Kumar A, Jain T. Comparison Between Betamethasone and Sodium Hyaluronate Combination with Betamethasone Alone After Arthrocentesis in the Treatment of Internal Derangement of TMJ-Using Single Puncture Technique: A Preliminary Study. *J Maxillofac Oral Surg* 2015;14(2):403-9.
40. Patel P, Idrees F, Newaskar V, Agrawal D. Sodium hyaluronate: an effective adjunct in temporomandibular joint arthrocentesis. *Oral Maxillofac Surg* 2016;20(4):405-10.
41. Kunjur J, Anand R, Brennan PA, Ilankovan V. An audit of 405 temporomandibular joint arthrocentesis with intra-articular morphine infusion. *Br J Oral Maxillofac Surg* 2003;41(1):29-31.
42. Aktas I, Yalcin S, Sencer S. Intra-articular injection of tenoxicam following temporomandibular joint arthrocentesis: a pilot study. *Int J Oral Maxillofac Surg* 2010;39(5):440-5.
43. Emes Y, Arpinar IS, Oncu B, et al. The next step in the treatment of persistent temporomandibular joint pain following arthrocentesis: a retrospective study of 18 cases. *J Craniomaxillofac Surg* 2014;42(5):65-9.
44. Malik AH, Shah AA. Efficacy of Temporomandibular Joint Arthrocentesis on Mouth Opening and Pain in the Treatment of Internal Derangement of TMJ-A Clinical Study. *J Maxillofac Oral Surg* 2014;13(3):244-8.
45. Al-Moraissi EA. Arthroscopy versus arthrocentesis in the management of internal derangement of the temporomandibular joint: a systematic review and meta-analysis. *Int J Oral Maxillofac Surg* 2015;44(1):104-12.
46. Nitzan DW, Samson B, Better H. Long-term outcome of arthrocentesis for sudden-onset, persistent, severe closed lock of the temporomandibular joint. *J Oral Maxillofac Surg* 1997;55(2):151-8.
47. Kuruvilla VE, Prasad K. Arthrocentesis in TMJ Internal Derangement: A Prospective Study. *J Maxillofac Oral Surg* 2012;11(1):53-6.
48. Kim YH, Jeong TM, Pang KM, Song SI. Influencing factor on the prognosis of arthrocentesis. *J Korean Assoc Oral Maxillofac Surg* 2014;40(4):155-9.