A literature review of temporomandibular joint arthrocentesis: start to success

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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.


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

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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 retrodisical 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.
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 including 25-29: 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 technique17, 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. Forty 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 corticosteroid\textsuperscript{37-39}, sodium hyaluronate (SH)\textsuperscript{24, 40} morphine\textsuperscript{23, 41} or non-steroidal anti-inflammatory drugs (NSAIDs)\textsuperscript{42, 43} are injected into the joint.

Figure 1. The two-needle technique anatomical landmark for TMJ arthrocentesis. The red line represents the Holmlund-Hellsing line. \textit{A} point represents for the first needle which indicates the location of the articular fossa and \textit{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\%\textsuperscript{17, 28, 34, 44, 45}

### The success rate and prognosis

The overall success rate of TMJ arthrocentesis is estimated to be 70-95\%\textsuperscript{14, 46-48} Murakami et al.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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.\textsuperscript{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


