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Current Concepts on Temporomandibular Disorders

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TMJ Arthrocentesis

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The term TMJ arthrocentesis refers to lavage of the upper joint compartment by means of a liquid, using needles for inflow and outflow. This technique was first introduced at the beginning of the 1990s and is derived from TMJ arthroscopy.¹ Arthroscopy was applied to the human TMJ in the year 1975 by Onishi² and had much success during the mid-1980s and the beginning of the 1990s due to the popularization of mini-arthrosopes and development of dedicated miniature surgical instruments. However, since then, owing to the promising findings of studies on the efficacy of arthrocentesis, an extremely low-cost procedure, TMJ arthroscopy has fallen out of favor as it does not offer any advantages over arthrocentesis in terms of efficacy. It also does not have any advantages over open surgery in terms of the postsurgical course.³ Indeed, although TMJ open surgery is a delicate procedure, patients do not need to remain in hospital for follow-up and are usually discharged on the following day as in the case of operative arthroscopy. Moreover, the technique is associated with a steep learning curve, requiring a long training period before a surgeon can safely carry out operative arthroscopy, and it is also associated with greater risks due to the limited vision of the surgical field with an arthroscope.

Many authors have observed that the most common reason for the success of TMJ ar-

throscopy was the simple fact that the patient underwent an effective intervention with the use of tiny and sophisticated instruments and without the need for complicated maneuvers to recapture and fix the disc and remove the adhesions within the joint. In other words, "lysis and lavage" was sufficient to reach a favorable outcome, without the need for any other associated procedure. The flow of a liquid under pressure through the joint in itself allowed flushing of catabolites, distension of the joint with breakage of some adhesions and mobilization of the disc.⁴ Dorrit Nitzan was the first author to publish an article in which the word "arthrocentesis" of the TMJ appeared. Although the use of this term was not exactly accurate (arthrocentesis means drainage of a liquid from an inflamed joint), the concept she drew attention to was innovative: to obtain similar results to those achieved with an arthroscope by simply using two needles.¹

The advantages of arthrocentesis of the TMJ are:

- It can be carried out under local anesthesia with no need for sedation
- It does not require specialized hardware (arthroscope)
- It is easy to learn
- The technique is only a little invasive
- It can be done in an outpatient clinic setting

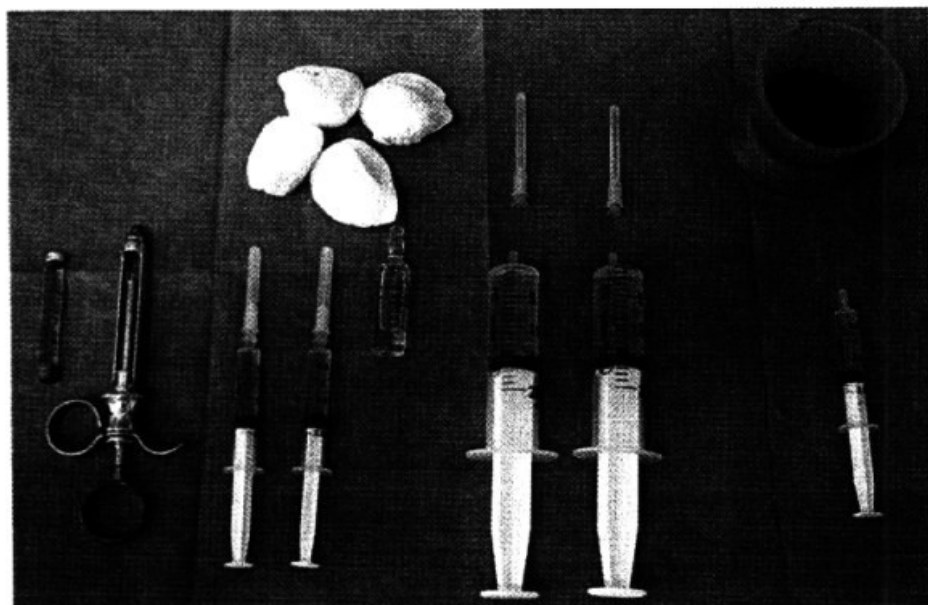


Fig. 26-1 The simple instruments required to perform arthrocentesis.



Fig. 26-2 The Holmlund line and outline of the articular tubercle and glenoid fossa.

- The only materials required are needles, anesthesia, and saline.

In addition, compared with arthroscopy, there is no need for imaging and although no sophisticated surgery is carried out the results are good and costs very limited. Through the arthrocentesis needles, it is possible to inject into the joint not only saline but also drugs for specific treatments, such as morphine,^{5,6} corticosteroids,⁷ and hyaluronic acid.⁸⁻¹² For these reasons, TMJ arthrocentesis is becoming more and more popular, and has almost replaced arthroscopy as a first-step minor surgical procedure.

Technique

All the instruments needed to perform an arthrocentesis are illustrated in Figure 26-1. TMJ arthrocentesis is currently performed utilizing the same landmarks as used for arthroscopy. A line connecting the mid-tragus to the lateral canthus of the eye, ie the Holmlund line, is drawn on the patient's face. Next, the patient is asked to open wide his or her mouth in order

to better define the glenoid fossa, which is now empty, and the articular tubercle. For ease of reference, it is a good habit to mark on the skin the position of these structures together with the outline of the mandibular condyle (Fig. 26-2). The correct insertion site for the first needle is usually 10–12 mm in front of the tragus and 2–3 mm below the Holmlund line. However, the operator should check the location of the empty glenoid space with a finger to ensure that the points are marked correctly.

The second needle, through which the fluid flows out, can be placed either a few millimeters in front of the first one or, as suggested for arthroscopic surgery, around 2 cm in front of the mid-tragus and 1 cm below the canthal-tragus line. The position of the second needle is not that critical, as arthrocentesis does not require any triangulation as in the case of arthroscopy; also it is much easier to place the second needle in the posterior recess of the upper joint space.¹³

Arthrocentesis is usually performed under local anesthesia (lidocaine/epinephrine); for good analgesia in the preauricular area, the correct technique involves inserting a fine needle into the subcutaneous tissues of the mandibular angle, and then pushing the needle superi-



Fig. 26-3 Anesthetizing the preauricular area.



Fig. 26-4 Anesthetizing the upper compartment.



Fig. 26-5 Using the forefinger as a guide, a 19-gauge needle is introduced into the upper compartment.

only until the TMJ area, where the anesthetic (2 mL) is injected (Fig. 26-3). A second injection of anesthetic is given first around the capsule and then inside the joint itself (2 mL lidocaine) (Fig. 26-4). That the needle has correctly entered the joint and that the anesthetic has been injected inside the articular space is confirmed by the movement of the patient's mandible towards the opposite side, with outflow from the needle if the patient closes their mouth.

This technique allows anesthetizing the joint and the auriculotemporal nerve. The adverse effects are related to the risk of anesthetic spreading to the zygomatic nerve and/or temporal branches of the facial nerve, which leads to a temporary deficit in eyelid elevation. Once the preauricular area has been anesthetized, the first arthrocentesis needle can be introduced into the upper compartment of the joint. The patient is asked to open the mouth wide in order to keep the glenoid fossa empty and to gain space. Then a 19-gauge needle, supported and guided by the forefinger, is introduced into the joint space in a lateromedial, inferosuperior, and posteroanterior direction, with the bevel oriented upwards (Fig. 26-5). Once the joint is entered there is outflow of the previously injected anesthetic (Fig. 26-6); the joint

is distended by injecting some saline, and then the second 19-gauge needle is inserted, below and in front of the first one (Fig. 26-7), using a similar technique as before; as the needle enters the joint space there will be some outflow through it (Fig. 26-8). Once the two needles are inside the joint (upper compartment), arthrocentesis can be performed by using a single syringe several times (Fig. 26-9) or connecting the needle to a bag or bottle containing 500 mL of physiological saline or Ringer's lactate solution. Ideally, joint lavage requires use of at least 300 mL of saline or Ringer's lactate solution¹⁴ (Figs 26-10a, 26-10b). It is important to note that if the outflow stops or if there is swelling in the preauricular area, the needles will need to be reinserted. At the end of the lavage, one needle is removed and a drug – usually a corticosteroid or hyaluronic acid – can be injected through the remaining needle (Fig. 26-11).

Some interesting modifications to the original technique and protocol have been proposed to increase the intra-articular pressure and to potentially improve the effectiveness of arthrocentesis.^{9,15} Among these is a treatment cycle consisting of one session of arthrocentesis plus hyaluronic acid injection once a week for 5 weeks, with the aim of improving removal of



Fig. 26-6 The outflow of the anesthetic confirms that the needle has entered the joint.

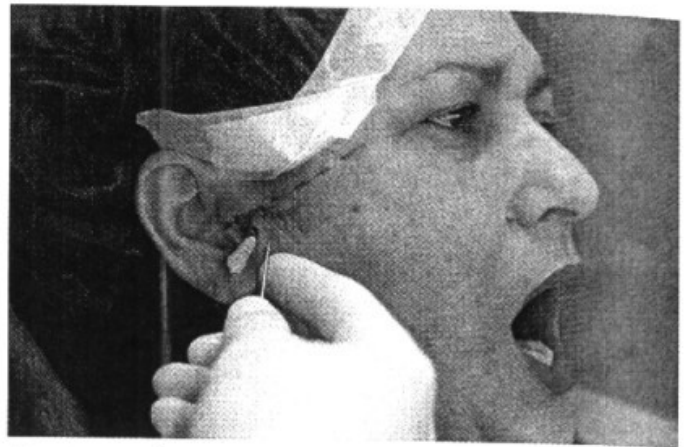


Fig. 26-7 The second needle is introduced in front of and below the first one.



Fig. 26-8 Outflow of liquid from the second needle indicating that it has entered the joint.

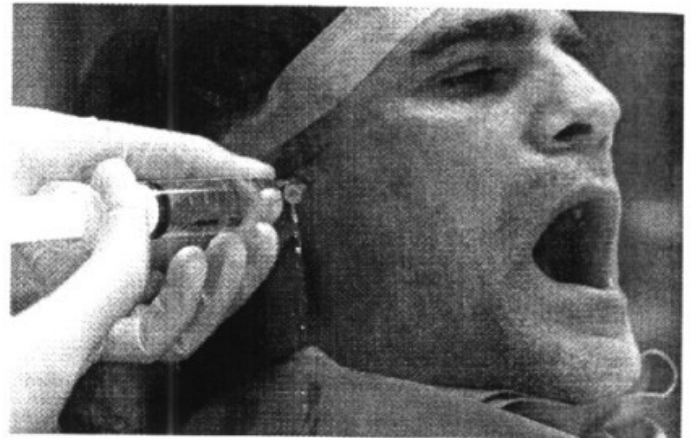


Fig. 26-9 Lavage of the joint carried out by using a syringe.

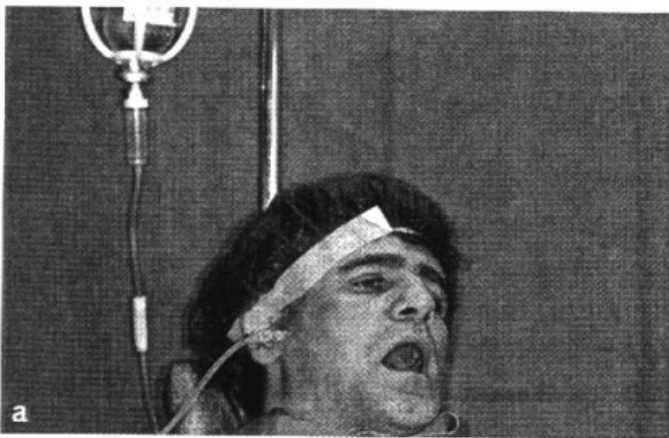


Fig. 26-10 a, b Continuous lavage performed by connecting the needle to a bottle of Ringer's lactate solution.

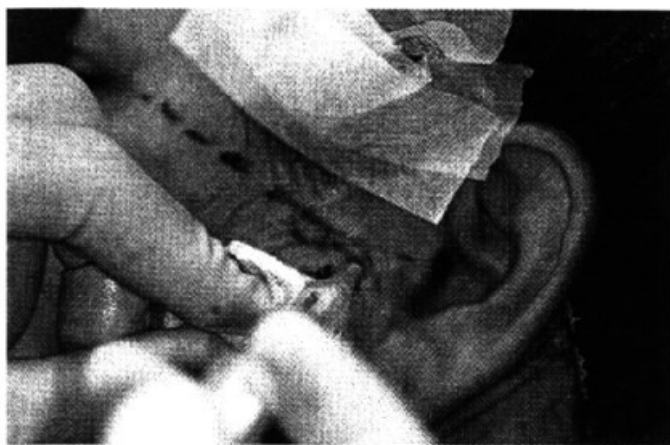


Fig. 26-11 At the end of the lavage, once the second needle has been removed, hyaluronic acid may be injected.

catabolites, achieving better joint mobilization, and, in the case of osteoarthritis, prolonging the action time of hyaluronic acid.¹² Another variation is single-needle arthrocentesis, in which only one needle is used for both fluid injection and aspiration.¹⁶ Preliminary data on the use of this technique are promising,¹⁷ and future trials should attempt to verify whether the single-needle technique allows achieving all the potential advantages suggested by the authors, that is, it is better tolerated, less traumatic, and easier to perform if adhesions are present. This is because first, higher pressure can be exerted for breaking the adhesions, and second, if a drug is injected its chances of retention inside the joint are higher (Box 26-1).

Box 26-1 Potential advantages of the single-needle technique over the two-needle approach.

- Better tolerated
- Less trauma
- Higher intra-articular pressure
- Technically easier
- Greater retention of drugs injected after joint lavage

Indications

Arthrocentesis is indicated in conditions characterized by joint degeneration and internal derangement, which are included in the Research Diagnostic Criteria for Temporomandibular Disorders (RDC/TMD) diagnostic groups of disc displacements and inflammatory-degenerative disorders (Box 26-2). From a clinical viewpoint, it may also be useful to keep in mind that the following conditions and situations could benefit from arthrocentesis.

Box 26-2 Indications of TMJ arthrocentesis, alone or combined with drugs, on the basis of RDC/TMD diagnostic groups.

- IIa. Disc displacement with reduction^{A+HA}
 - IIb. Disc displacement without reduction with limited opening^A
 - IIc. Disc displacement without reduction without limited opening^{A+HA}
 - IIIa. Arthralgia^{A+C}
 - IIIb. Osteoarthritis^{A+HA}
 - IIIc. Osteoarthritis^{A+HA}
- ^A – arthrocentesis; ^{HA} – hyaluronic acid;
^C – corticosteroids.

Acute Closed Lock

An acute closed lock is usually caused by either an anterior disc displacement (ADD) without the possibility to recapture the disc during mouth opening (ADD without reduction) or the anchored disc phenomenon (ADP).

Acute ADD is a condition in which magnetic resonance imaging (MRI) shows that the disc is dislocated anteriorly with respect to its normal position (see Chapter 5); it can be treated successfully with arthrocentesis as its hydraulic action increases the volume of the upper joint. This allows an increase in the range of antero-inferior translation of the condyle, and, in a few patients, it may allow recapturing the con-

dyle's normal spatial relationship with the disc. This latter situation may occur only in patients with acute closed lock in joints with a disc that has retained its biconcave morphology and not already created adhesions.^{18,19}

The ADP is a condition of sudden, severe, and persistent limited mouth opening, with MRI showing the disc in the physiologic position with respect to the condyle. This readily responds to arthrocentesis. It has been postulated that ADP is the result of an alteration of the TMJ lubricating system (see Chapter 6). Sliding of the disc in the TMJ is enabled by the presence of phospholipids protected by hyaluronic acid, which together constitute an efficient lubrication system. Joint overloading may be associated with uncontrolled production of reactive oxygen species that causes degradation of the hyaluronic acid, followed by the exposure of the phospholipids to lysis by phospholipase A2. The denuded, smooth, and elastic articular surfaces that possess high-surface energy become strongly adherent when placed in direct physical contact with each other. These adhesive forces are probably responsible for the flexible disc anchorage to the fossa and/or eminence. They also explain the immediate release of the disc and restoration of sliding following arthrocentesis.^{18,20-22}

Chronic Closed Lock

Chronic closed lock can be the result of a persistent ADD without reduction or intra-articular adhesions or both conditions together. Thanks to arthrocentesis, it is possible to mobilize the disc to a certain degree. However, even if there is an improvement in the range of mandibular motion, the disc usually remains dislocated anteriorly. In order to maintain, and possibly improve, the results achieved with arthrocentesis, an extended program of passive exercises for joint mobilization is strongly recommended.²³⁻²⁶

Osteoarthritis and Arthrosis

Patients affected by osteoarthritis and arthrosis, when treated with arthrocentesis, experience decreased pain and an improvement of jaw movements due to the effect of joint lavage.^{10-12,27}

Rheumatoid Arthritis

TMJ arthrocentesis is a useful adjunct in the short-term management of the symptoms related to rheumatoid arthritis.^{28,29}

TMJ Trauma

Trauma can cause inflammatory and degenerative changes inside the joint. Arthrocentesis removes blood coagulation products and degenerated and inflammatory cells and crystals. Biochemical analysis of the lavage products has shown considerable amounts of leukotriene B and prostaglandin E in the synovial fluid of trauma patients, and a thorough joint lavage may be of much help to reduce the concentration of such inflammatory mediators.³⁰

TMJ Pain

The effectiveness of joint lavage in patients with painful TMJs can be explained by the washing out of inflammatory mediators and catabolites, such as leukotriene B and prostaglandin E, nitrite, bradykinin.^{31,32} In the most severe cases, arthrocentesis can be followed by intra-articular morphine infusion in an attempt to give long-term pain relief.⁵

Loud Clicking

Arthrocentesis may be indicated for patients with TMJ dysfunction characterized by loud and socially unacceptable clicking sounds when opening their mouth. In these patients, joint

lavage, possibly accompanied by injection of hyaluronic acid, may help smoother condylar gliding during translation and thus reduce the loudness of the sounds.^{8,33}

Rehabilitation of the Contralateral Joint

Arthrocentesis can be utilized to mobilize the contralateral side of joints that have been treated surgically for ankylosis. Arthrocentesis may break the adhesions that are responsible for the reduced movement of the condyle and the disc in a joint that was not able to move properly due to the presence of contralateral pathology.³⁴

Drugs after Arthrocentesis

Through its mechanical action, arthrocentesis allows removal of catabolites and inflammatory mediators. Owing to this effect, which is achieved by the joint distension, disc mobilization, breakage of adhesions, and wash-out action, arthrocentesis plays an important role in "preparing" the joint to receive drugs for specific treatments which can be injected at the end of the procedure. The literature suggests that the most commonly used drugs for this purpose are corticosteroids,⁷ morphine,⁵ and hyaluronic acid:⁸⁻¹²

- Corticosteroids may be used in patients with severe acute pain, elderly patients, or poorly cooperative patients.
- Morphine is indicated in those rare cases of pain resistant to conventional treatments, with the purpose obtaining long-term pain relief.
- Hyaluronic acid (low molecular weight) is used with the intention to restore joint functionality; high molecular weight hyaluronic acid is preferred in those rare cases where a purely mechanical action is required and in elderly patients with a severely compromised joint.

Published data seem to suggest that low molecular weight hyaluronic acid is the most widely used drug for TMJ injections, alone or after arthrocentesis, and a brief description of its characteristics and mechanism of action may be useful. Hyaluronic acid is a polysaccharide that belongs to the family of glycosaminoglycans, which can be found in many extracellular tissues, including synovial fluid and cartilage. It is produced by chondrocytes and synoviocytes of the joints. Under physiologic conditions, this substance plays an important role in maintaining intra-articular homeostasis. By enhancing the elasticity and viscosity of the synovial fluid, it allows the fluid to act like a cushion against any shocks. Hyaluronic acid also has a lubricating, anti-inflammatory, and pain-relieving action that enables tissue-repair processes to be activated in the cartilage with a normalizing action on the synthesis of endogenous acid by the synovial cells.

In patients with osteoarthritis, hyaluronic acid becomes depolymerized, resulting in a decrease in its molecular weight and viscoelasticity. These alterations increase the cartilage's susceptibility to injuries. The injection of exogenous hyaluronic acid into the joint following arthrocentesis stimulates the synthesis of endogenous hyaluronic acid-forming synoviocytes in osteoarthritic joints, so reducing the coefficient of joint friction and decreasing the risk of damage. Besides, hyaluronic acid has been claimed to restore joint lubrication, delay osteoarthrosis, and improve TMJ function by protecting surface-active phospholipids from lysis by exogenous phospholipases.^{35,36} Treatment with hyaluronic acid has proved effective in patients with inflammatory-degenerative disorders¹⁰⁻¹² and internal derangement.^{8,9}

The most effective protocol seems to be the combination of arthrocentesis and hyaluronic acid injection,⁸ given as five injections (one per week).¹² This five-injection protocol is based on the positive findings described with a similar approach in the knee and other larger joints.^{37,38} Studies on patients with osteoarthritis of the TMJ have also shown significant improvements in patients' symptoms with this

protocol and that this was also the most effective TMJ treatment with regard to maintenance of results over time.¹²

Complications

The list of potential complications associated with TMJ arthrocentesis is short and their frequency of occurrence is low. A little bleeding in the preauricular area can occur and temporary anesthesia of the frontozygomatic branch of the facial nerve, with inability to lift the eyelid, are the two most commonly described complications and are hardly significant in terms of affecting patients' quality of life or perception of treatment efficacy because of their low rate of occurrence and reversibility. One case of extradural haematoma following TMJ arthrocentesis that led to hemiparesis has been described.³⁹

Conclusions

Arthrocentesis is a treatment that must be considered within the overall scheme of management of patients affected by TMJ disorders; it occupies an intermediate place between medical and surgical therapeutic approaches and has some potential advantages with respect to other treatments. In particular, arthrocentesis alone, or followed by the intra-articular injection of medications, and in association with habit control and physical therapy, has been proven to be effective in increasing the range of mandibular motion and improving symptom management in patients with internal derangement and inflammatory-degenerative disorders. In those selected patient populations, joint lavage is an effective yet simple, less invasive, and less expensive technique with low morbidity that should be considered as an alternative to more invasive surgical procedures of the TMJ. In confirmation of these considerations, arthrocentesis has rapidly gained popularity in both research and clinical settings.

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