

Concentric-Needle Cannula Method for Single-Puncture Arthrocentesis in Temporomandibular Joint Disease: An Inexpensive and Feasible Technique

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Management of temporomandibular joint (TMJ) disorders presenting with pain, restricted mouth opening, or simply asymptomatic clicking can be challenging even to the experienced surgeon. Many conservative and invasive techniques are available, but most cases can be treated by arthrocentesis of the joint locally. A simple process of joint irrigation enables lysis of intra-articular adhesions, change in the joint viscosity, and clearance of various substances in the joint fluid. Classically, arthrocentesis of the TMJ has been performed with 2 needles: an infusion needle and an aspiration needle. Various devices and techniques have been described in the literature, each with its own benefits and drawbacks. We introduce our technique of TMJ lavage using 2 different gauge needles placed in a concentric manner; hence, besides a less traumatic and easier puncture of the joint capsule, the lavage and aspiration of the joint space can be performed efficiently, with minimal morbidity. The use of a concentric-needle cannula system is the least traumatic and perhaps the most cost-effective method for TMJ lavage described to date. We believe that this technique is applicable and can be performed by even the inexperienced surgeon.

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Disorders of the temporomandibular joint (TMJ) due to internal derangements of the joint capsule are common, with patients often presenting with pain in the preauricular region, restricted mouth opening, tenderness of the TMJ region, asymptomatic TMJ clicking, or locking of the joint.^{1,2} Management of this condition can be challenging, including a spectrum of conservative jaw exercises, occlusal splints, lifestyle

and behavioral changes, and use of simple drugs such as nonsteroidal anti-inflammatory drugs, myorelaxants, and tricyclic antidepressants.^{2,3} Other minimally invasive treatment modalities include manipulation of the joint by arthroscopic lysis, as well as arthrocentesis of the joint.^{1,2}

TMJ arthrocentesis for lysis and lavage was first described by Nitzan et al⁴ as a procedure performed with the patient under local anesthesia for irrigation of the superior TMJ space and release of the joint, with results showing improved function, increased range of motion, and a decrease in pain.⁵ This simple and minimally invasive technique gained widespread popularity⁵⁻⁷ after the success of arthroscopic lavage and lysis performed in the early 1990s,¹ taking its place as the first surgical intervention in patients unresponsive to conservative management by many authors.⁷

Being a straightforward, inexpensive, and minimally invasive procedure, arthrocentesis for TMJ can be performed in an office setting, on an outpatient basis, with local anesthesia.⁸ It allows lavage of the joint space and lysis of adhesions through hydraulic distention in addition to a change in the TMJ fluid

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viscosity and clearance of proteins, bradykinin, and interleukin 6 in the TMJ fluid.⁹

Arthrocentesis of the TMJ can be performed by various techniques with different irrigation solutions by use of different volumes,^{9,10} with success rates defined in the range of 70% to 91%.¹¹

The technique of joint irrigation can be performed under low pressure with a hanging infusion bag or at a higher pressure by use of a syringe. The techniques in use include lavage by use of arthroscopic lysis, 2-needle arthrocentesis, the double-needle cannula method, single-needle arthrocentesis, use of a single Shepard cannula with 2 ports and 2 lumens,² and single-puncture arthrocentesis.^{7,12}

The method for arthrocentesis has been classically described as infusion of perfusate into the superior joint space through a needle placed percutaneously and aspiration of the solution through a second needle placed separately in the same way,^{4,12} with 1 needle for the inflow of the lavage solution and the second for outflow.

Concentric-Needle Single-Puncture Arthrocentesis: Surgical Technique

We hereby introduce an inexpensive, practical, and clinically feasible method for low- or high-volume TMJ irrigation. This technique has been approved by our local institutional review board.

Our method consists of inserting a 27-gauge, 50-mm-long needle into a 21-gauge, 38-mm needle (Fig 1A,B). The longer 27-gauge needle does not block the end of the larger needle hub from which the perfusate outflows; moreover, both needle tips lie in the same point, as shown in Figure 1C. In this way, joint irrigation is performed through the inner needle with the perfusate outflow through the outer needle hub. Irrigation through this concentric-device combination, therefore, allows single puncture of the TMJ with a single needle, including the advantage of a simultaneous second outflow mechanism, hence lavage through a single unit.

The patient is given an oral sedative 30 minutes before the procedure, which is always carried out at the hospital. Antisepsis of the puncture area is performed, and a cotton pledget is placed in the external auditory meatus to prevent the irrigation solution from entering the ear. Local anesthesia is performed to the puncture area, blocking the auriculotemporal nerve with 20% lidocaine and 1:80,000 epinephrine solution, followed by a deeper injection to anesthetize the joint capsule. A horizontal line is drawn from the corner of the eye to the tragus (Holmlund line) as described by Nitzan et al,⁴ and a puncture mark is

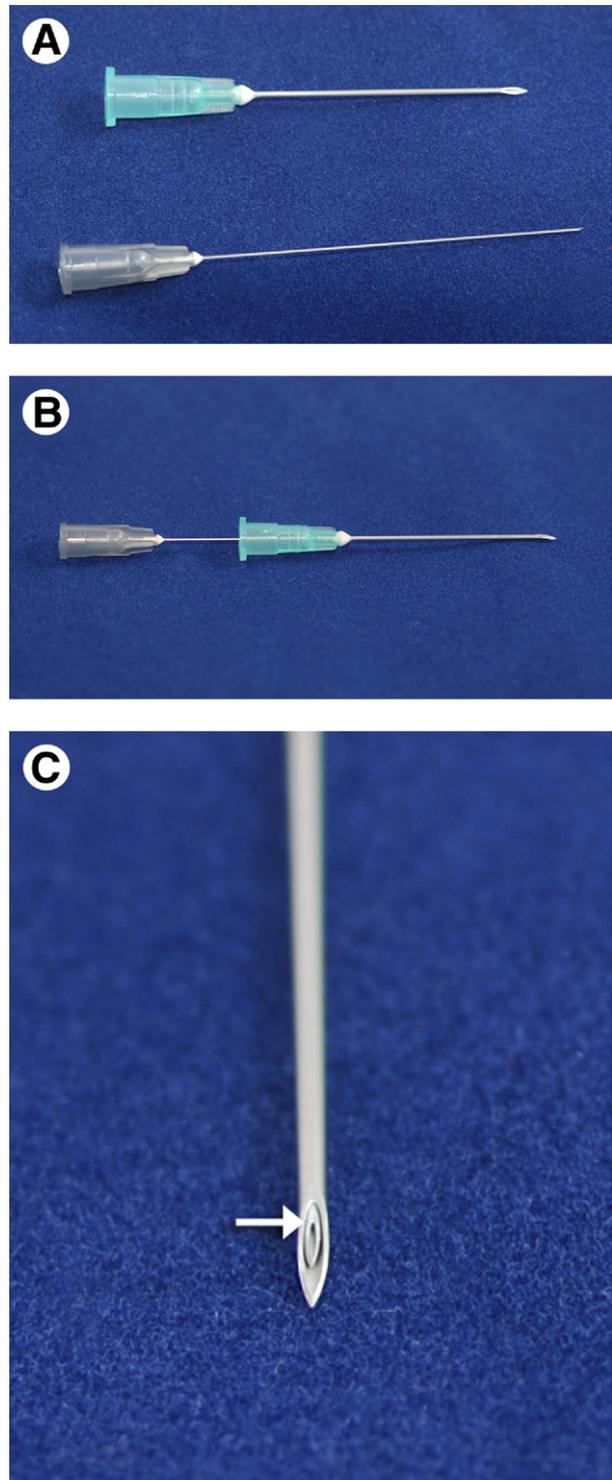


FIGURE 1. A, A 27-gauge 50-mm needle and a 21-gauge 38-mm needle. B, The 27-gauge needle inserted into the 21-gauge needle. C, Concentric-needle cannula system tip for single-puncture arthrocentesis. The arrow shows the 27-gauge needle tip inside the 21-gauge needle. Both needle tips lie in the same plane.

Öreroğlu et al. Concentric-Needle Cannula for TMJ Arthrocentesis. *J Oral Maxillofac Surg* 2011.



FIGURE 2. Concentric-needle irrigation system for TMJ lavage in use. One should note the lavage fluid flows out through the space between the 2 needles (through the 21-gauge needle) and out of the external needle hub.

Öreroğlu et al. Concentric-Needle Cannula for TMJ Arthrocentesis. J Oral Maxillofac Surg 2011.

made 10 mm from the tragus and 0.5 mm below this line. The concentric-needle unit is inserted into the upper joint space while the patient is asked to open the mouth halfway to allow entry of the needle. Once it is inside the joint space, lavage is performed with lactated Ringer solution, with special attention being paid to the localization of the needle tips. Extra care is taken not to dislocate the puncture site while irrigation is being performed, which can cause extravasation of the fluid into the surrounding soft tissues. Irrigation is controlled while inflow and outflow fluid volume is visualized through the needle hub with each injection. The injection fluid will show significant pressure resistance if not in the joint cavity, and the procedure is aborted immediately if the patient feels significant pain and the puncture site is changed (Fig 2).

Lavage is performed with a syringe when minimal joint irrigation is required (50 mL). However, an infusion bag can be used for delivery of the irrigation solution when larger volumes are needed (up to 500 mL).

Discussion

The classical method for arthrocentesis uses 2 needles placed separately into the TMJ space.⁴ These 2 needles require an exact triangular placement in the

upper joint space for the procedure to be efficient. Being a blind procedure, insertion of the outflow needle into the correct space can be much more difficult after placement of the first input needle, which is an easier procedure. Displacement of the needles, either input or outflow, during the lavage procedure is another difficulty encountered by most surgeons practicing this technique. Maintaining the exact needle positions during irrigation can be challenging, whereas repetitive insertions of needles lead to extra-articular leakage and can damage the joint capsule, increase the risk of facial nerve injury, or increase the risk of intra-articular bleeding and hematoma.¹³

The advantages of the single-needle method include the use of a single puncture for both irrigation and outflow, hence achievement of efficient arthrocentesis without the need for a second needle, decreasing the risk of losing the correct place during lavage, as well as yielding less patient discomfort, a lesser risk of infection, and less bleeding.¹³

The positioning of a single needle allows clear and stable access to the joint space, eliminating the risk of interference that may occur with a second needle in the classical technique.¹⁴ In addition, a single puncture reduces patient pain in the postoperative period, reducing the need for extra care postoperatively. The amount of local anesthesia is much less for a single puncture than that needed for a double-puncture or arthroscopic approach, thus reducing the morbidities and complications due to local anesthetics.¹⁴

A single-needle technique reduces the risk of facial nerve injury, because an anteriorly positioned second needle can traumatize the facial nerve, which lays anteriorly and medially to the glenoid fossa, just where the second needle is inserted.¹⁴ This risk is even higher in cases with hypomobile joints that make the correct insertion of the second needle almost impossible.¹⁴

Weekly injections of hyaluronic acid immediately after arthrocentesis have been shown to improve signs and symptoms in patients with painful TMJ disease.^{15,16} We believe that use of a single-puncture technique will provide the advantage of preventing hyaluronic acid leakage from the joint space due to a second outflow needle or the second point of injection.¹⁶ In addition, a single needle will create more pressure in the joint space, supporting Yura's high-pressure hypothesis, increasing the effectiveness of the lavage procedure.¹²

A TMJ lavage instrument (ACE Surgical Supply, Brockton, MA) with double needles used as a single cannula, though not so popular, has been previously introduced by McCain.¹⁷ The use of this instrument brings about the advantages associated with a single puncture and has the disadvantage of a large diame-

FIGURE 3. A, Double-needle single-puncture irrigation device, with 2 needles welded in a Y fashion. B, Double-needle single-puncture Y device in use.

Öreroğlu et al. *Concentric-Needle Cannula for TMJ Arthrocentesis*. *J Oral Maxillofac Surg* 2011.

ter, necessitating the use of a trocar.¹⁷ Besides, one must have access to such an instrument or find a way to manufacture a similar product.¹⁸

Rahal et al⁷ have developed a new device where two 18-gauge needles are bent 30° toward their respective opening and welded together in a Y fashion. They have the device manufactured by a local medical instrument company, packaged separately, and sterilized. Although this technique has not been published in the literature, we have been using it for the past few years, and welding the 2 needles ourselves at a local workshop, recognizing the disadvantage of the separate cost required for the manufacturing of the device (Fig 3A). However, the Y device is advantageous in cases where large volumes of irrigation solution need to be used, when compared with our new concentric-double needle technique, which is more suitable for lesser irrigation volumes. Our technique of welding 2 needles in a Y fashion, however, uses 21-gauge needles and is therefore less traumatizing than the device of Rahal et al, for which they use 18-gauge needles. This technique comprises a double puncture with 2 needles side by side and hence is more trau-

matic than a single needle puncture. We believe it can be used in cases where large volumes of solution and high pressure are required (Fig 3B).

Alkan and Baş¹⁸ have shown the use of the McCain cannula¹⁷ in a single patient for arthrocentesis. Rehman and Hall² have used a Shepard cannula to perform the procedure. These devices are not available in every country, and besides having an extra cost, they are much more traumatizing than single-puncture techniques using injection needles. However, use of such devices may be advantageous for high-pressure lavage.

Another advantage that our technique using concentric needles with a single puncture has over the other techniques described, mainly the McCain cannula, is the facilitated ability to puncture narrower joints with osteophytic changes in severe degenerative diseases,¹⁸ thanks to the use of a single 21-gauge (0.8-mm) needle as compared with devices with diameters exceeding 1.5 mm. Use of a concentric-double needle system through a single 21-gauge needle puncture is the least traumatizing and most cost-effective technique described to date.

Use of a concentric-needle system reduces the time and increases the ease of preparation for the lavage procedure when compared with previous studies,¹⁴ which require device manufacturing, preparation, and extra sterilization.

When compared by using the same volumes of irrigation solution, performing lavage using the concentric-needle cannula technique takes more time than the Y-device technique. This can, however, be overwhelmed by using a perfusion bag; hence a steady and continuous lavage is performed. On the other hand, when a high-pressure lavage is mandatory, the use of the Y-fashion single-puncture device can be adequate.

We believe the straightforward and inexpensive preparation, sterilization, and availability of the needles used in this technique require major emphasis and represent a major contribution to the arthrocentesis techniques used by many surgeons for TMJ disease.

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