

## EFFECTIVENESS OF ARTHROCENTESIS IN THE TREATMENT OF INTERNAL TEMPOROMANDIBULAR JOINT DISORDERS AFTER MANDIBULAR CONDYLAR FRACTURES

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### Abstract

Manifestation of traumatic disorders is often characterised by reorganization or ossification of the TMJ hematoma, while the use of conservative therapy after TMJ traumatic injuries is often ineffective. The purpose of the present work was to study the effectiveness of arthrocentesis in the complex treatment of post-traumatic temporomandibular disorders. 24 patients with a history of mandibular condylar fractures underwent CT, ultrasound and MRI. TMJ arthrocentesis was performed under local anesthesia. After osteosynthesis, the number of patients with stage III according to Wilkes was up to 58.33% while, after splinting - 33.33%. The control ultrasound and MRI carried out 3-6 months after arthrocentesis showed no signs of hemarthrosis in 84.61% of patients with intra-articular disorders of the second degree, and also in 72.72% of patients with internal disorders of the third degree, the position and function of the articular disc being restored. Arthrocentesis with TMJ lavage is a minimally invasive surgical manipulation that has proven useful in temporomandibular disorders of traumatic origin, in particular after fractures of the articular process of the mandible.

**Keywords:** mandibular fractures, TMJ disorders, arthrocentesis.

### 1. INTRODUCTION

Temporomandibular joint injuries often lead to their progressive disorder [1]. The traumatic origin of TMJ disorder, according to foreign authors, was found in 42-62.5% of the examined patients [2,3]. Etiopathogenesis of traumatic lesions of the temporomandibular joint includes contusions, fractures of the mandible and dislocations. Pullinger *et al.* (1991) classified the consequences of trauma into six groups: disc dislocation with and without reduction, primary and secondary osteoarthritis, myalgia and subluxation [4]. The most common complications of TMJ injury are

contusion, acute post-traumatic arthritis, damage of TMJ soft tissue components, deformation or rupture of the joint capsule, change in shape, violation of the integrity of the articular disc or its separation, sprain or rupture of ligaments, damage to the articular surfaces. [5-7].

On the basis of studies conducted among 164 patients with fractures of the mandibles of various localization, Skrypka evidenced temporomandibular joint disorders in 100% of the patients with fractures of the cervical region and coronary process of the mandible, and in 67.68% of the cases with median and lateral fractures. The incidence of temporomandibular disorders increased with age, up to 89.76% on the average, at ages of 36-55 years. [8].

The authors believe that intra-articular changes are more often caused by the internal articular localization of the fracture, however even the extra-articular fractures of the mandible can also damage the structural elements of TMJ [9]. A significant part of the internal articular disorders results from macro- and microtrauma of the temporomandibular joint.

A common sign of internal TMJ disorders is synovia, characterized by proliferation of synoviocytes and tissue hypertrophy. Synoviocytes release inflammatory mediators and matrix-degrading enzymes into the joint cavity. At the same time, their activation is secondary in relation to inflammatory mediators and cartilage matrix molecules, after which the mechanism of progressive joint degeneration is triggered in the synovial tissue, according to the feedback principle [10].

Manifestation of traumatic disorders is characterised by reorganization or ossification of the TMJ hematoma (with hemarthrosis), which causes impaired mobility, adhesion of the articular disc and of other components, causing problems with mouth opening, chewing, and the like. Studies on the synovial fluid have shown an increase in the concentration of pro-inflammatory cytokines (IL-6, IL-8, IL-11), which results in increased adhesive forces and formation of negative pressure in the upper space of the joint, leading to the «adhesion» of the disc to the joint fossa [11].

It should be noted that the use of conservative therapy after traumatic injuries of TMJ (medication, physiotherapy, occlusive splints, selective teeth grinding, electroneurostimulation of the masticatory muscles, diet, psychological support, etc.), is often ineffective, even in combination with other procedures [12].

Therefore, the next stage in the complex treatment of post-traumatic temporomandibular disorders involves the use of minimally invasive surgical interventions, in particular - arthrocentesis.

Arthrocentesis is a puncture and lavage of the temporomandibular joint, which consists in aspiration followed by the introduction of a fluid into the joint cavity under pressure, which promotes the removal of metabolic products, hematoma remnants, destruction of adhesions, resulting in increased joint space volume and disc mobilization, so that the movement of the lower jaw is restored. For improving arthrocentesis, the classical technique describing the introduction of two needles into the upper space of the temporomandibular joint and a method of hydraulic pressure to perform lavage were introduced [13].

The purpose of our work was to study the effectiveness of arthrocentesis in the complex treatment of post-traumatic temporomandibular disorders.

## 2. MATERIALS AND METHODS

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The clinical part of the study included 24 patients (19 men and 5 women), with ages between 18 and 44 years, with a history of fractures of the mandibular articular process. Twelve of the

patients with displaced fragments underwent osteosynthesis with titanium mini-plates, while other twelve, without displaced fragments, experienced intermaxillary fixation. All patients came to the dental center of the "Danylo Halytsky" Lviv National Medical University within 3-6 months after injury and treatment of fractures, which was assessed as satisfactory. Prior to addressing the Center, the treatment for TMJ they received at home, namely: nonsteroidal anti-inflammatory drugs, analgesics, physiotherapy methods, did not give the desired positive effect.

Patients complained of moderate pain in the TMJ, which was exacerbated by prolonged chewing or eating solid food, limited mouth opening, and «clicking» in the joint. Patients underwent radiological examination: orthopantomography, CT, ultrasound and MRI. Patients with titanium mini-plates after osteosynthesis were subjected to ultrasound (US), and reposition and fixation of fragments were performed using intermaxillary fixation - to magnetic resonance imaging (MRI).

Pain assessment was performed according to VAS. Examination revealed that a significant number of patients have difficulties in assessing the intensity of pain in some points, so that we have somewhat simplified the visual analog scale of pain, as follows: no pain - 0 points, mild pain - 1-3 points, moderate pain - 4-6 points, severe pain - 7-9 points, excruciating pain - 10 points.

TMJ arthrocentesis was performed according to a modified method of Nitzan (1991), under local anesthesia, involving blocking the peripheral branch of the auricular-temporal nerve, under intravenous sedation. First, a trago-orbital line is drawn on the face (Holmund line), then the patient is asked to open his mouth to determine the contour of the articular fossa and articular tubercle, and mark these on the skin. The first point for a needle insertion is 10-12 mm in front of the ear lobe and 2 mm below the trago-orbital line. The second needle, through which the fluid enters the joint, is inserted 20 mm from the middle of the tragus and 5 mm down from the tragoorbital line [14]. The upper space was insufflated with 200 ml of Ringer solution. A 20-cm<sup>3</sup> syringe with a 18-mm needle was used. The duration of arthrocentesis was 20-30 minutes (Fig. 1). Patients were prescribed anti-inflammatory and analgesic



therapy, and advised to follow a gentle regimen and diet. Repeated examinations were performed 1, 3, 7 days day after arthrocentesis, and also after 1, 3, 6 months, with assessment of the following parameters: mouth opening volume and arthralgia (assessment of pain intensity according to VAS).

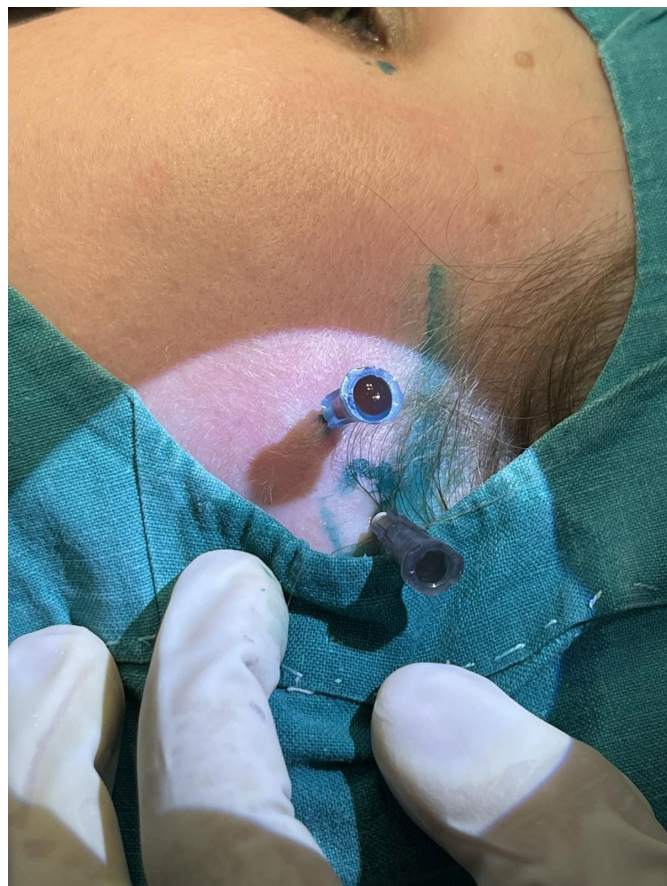


Fig. 1. Technique of TMJ arthrocentesis

### 3. RESULTS

On admission, patients complained of TMJ pain, rated 1 to 6 according to VAS. Also, all patients had pain on palpation of the TMJ. Limited mouth opening, ranging from 30 to 38 mm, was found in 11 patients and lower jaw deviation was observed in 18 of them. All patients produced articulatory noises - clicking, and 11 of them had blocked movement of the joint head. Orthopantomograms or CT revealed satisfactory restoration of the anatomical shape of the

mandible after fractures and complete consolidation of the fracture. Ultrasound and MRI revealed signs of unabsorbed hematoma (consequences of hemarthrosis) (Fig.2); in 18 patients - deformity of the capsule, in 17 - a slight thickening of the posterior edge of the articular disc, in 18 patients - disc adhesion (Fig.3), in 13 people - forward disc displacement with reduction (Fig.4), in 11 patients - disc protrusion without reduction (Fig. 5) (Table 1).

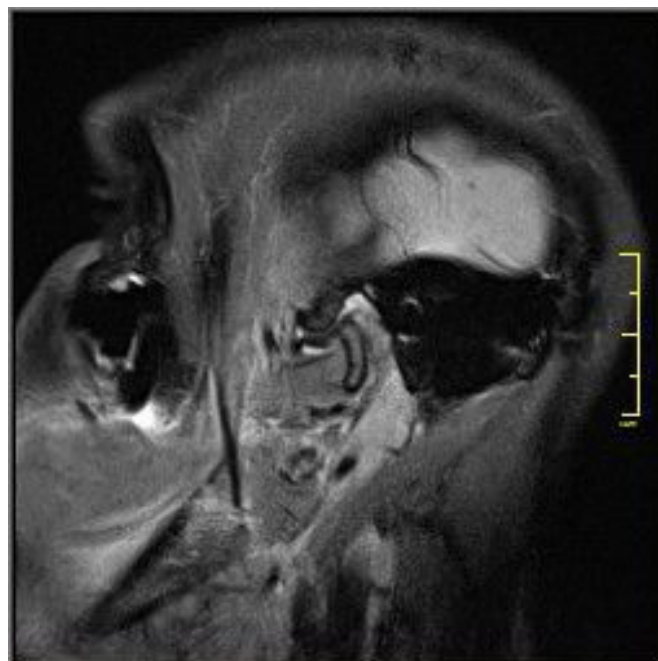


Fig. 2. MRI signs of hematoma, deformity and penetration of the capsule

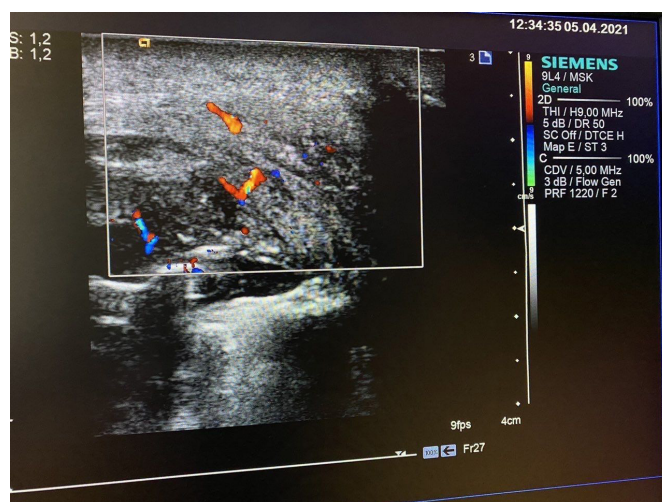


Fig. 3. Ultrasound features of disc adhesion

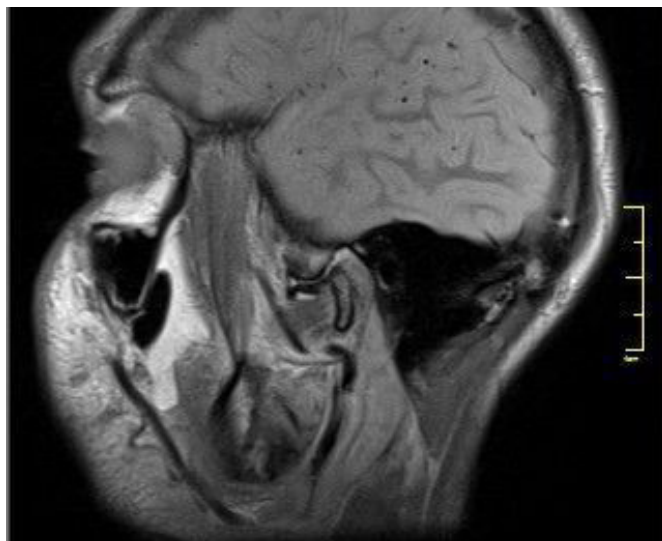


Fig. 4. MRI image of disc protrusion



Fig. 5. Ultrasound features of disc adhesion and protrusion without reduction

Table 1. Symptoms of temporomandibular disorders in patients 3-6 months after fracture of the articular process of the mandible

Symptoms of temporomandibular disorders	Number of patients by TMJ stages depending on the method of treatment			
	Intermaxillary fixation		Osteosynthesis	
	Stage II	Stage III	Stage II	Stage III
<b>Clinical symptoms</b>				
Pain associated with mandibular movement: 1-3 points	8	-	5	-
Pain associated with mandibular movement: 4-6 points	-	4	-	7
Pain not associated with mandibular movement: 1-3 points	-	4	-	7
Articulation noises (clicking)	8	4	5	7
Limited mouth opening		4	-	7
Periodic blocking of movements of the articular head	6	-	5	-
Deviation of the mandible	4	4	3	7
Pain on palpation	8	4	5	7
<b>Ultrasound and MRI symptoms</b>				
Deformation of the capsule	2	4	3	9
Disk deformation	3	4	3	7
Disc adhesion	3	4	4	7
Disc protrusion with reduction	5	-	8	-
Disc protrusion without reduction	-	4	-	7



According to the clinical and radiological signs observed after traumatic temporomandibular disorders, patients were divided into two groups, following Wilkes classification: 13 patients with stage II (early-middle) and 11 - with stage III (middle).

We also found that, after surgical treatment - osteosynthesis, the number of patients with stage III according to Wilkes was up 58.33% (7 persons) while, after splinting - 33.33% (4 persons).

After arthrocentesis, the TMJ condition improved within 2-3 day. In patients with TMJ blocking, jaw movements resumed immediately after lavage. The opening volume of the mouth on day 3 increased to 4 cm, and on day 7 it was fully restored. In the early postoperative period, pain was within 1-2 points while, after 1 month - 0. The control ultrasound and MRI carried out 3-6 months after arthrocentesis showed no signs of hemarthrosis in 11 (84.61%) patients with intra-articular disorders of the second degree, and in 8 (72.72%) patients with internal disorders of the third degree, the position and function of the articular disc being restored.

#### **4. DISCUSSION**

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Analyzing the results, we can assume that the method of treatment of mandibular fractures can hypothetically affect the disfunction of mandibular fractures. In particular, when evaluating clinical and radiological methods of examination, we found out that, after surgical treatment - osteosynthesis, the number of patients with stage III according to Wilkes is 1.75 times higher than of those who received conservative treatment. In our opinion, this may be due to the fact that, during the operation, namely during open repositioning and fixation of fragments, additional injury is inflicted on the structural elements of TMJ. On the other hand, osteosynthesis was performed in cases with a significant displacement of bone fragments, dislocation of the mandibular head, which could also play an important role in the development of more significant pathological processes [15,16].

Traumatic TMJ injuries often lead to inflammatory and degenerative changes in the joint. Arthrocentesis helps remove blood clots,

inflammatory cells, crystalline compounds and tissue breakdown products. Upper joint lavage reduces pain by leaching inflammatory substances (catabolism products, inflammatory mediators - cytokines, arachidonic acid) and tissue detritus products, increases the volume of mandibular movements, reduces the effects of intra-articular adhesions, eliminates negative pressure and triggers the movement of the disc in the correct position by blocking signs.

Given the lack of positive dynamics after conservative treatment and the presence of a pathological process in TMJ, confirmed both clinically and radiologically, arthrocentesis with TMJ lavage confirmed its effectiveness in traumatic injuries by 81.81-92.31%, which correlates with literature sources. The main advantages of arthrocentesis are the ability to perform manipulations in an outpatient setting, under local potentiated anesthesia, no need for complex expensive equipment (arthroscope), ease of execution, low invasiveness, and low percentage of postoperative complications [17].

#### **5. CONCLUSIONS**

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Arthrocentesis with TMJ lavage is a minimally invasive surgical manipulation that has proven itself useful in temporomandibular disorders of traumatic origin, in particular after fractures of the articular process of the mandible. Arthrocentesis is recommended after an ineffective conservative treatment, as well as for preventing post-traumatic intra-articular disorders in early post-treatment fractures (intermaxillary fixation or osteosynthesis) with the attenuation of acute post-traumatic events, which is to be investigated in further works.

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