

Arthroscopy of the Temporomandibular Joint for the Treatment of Chronic Closed Lock

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ABSTRACT: **Background:** Temporomandibular joint (TMJ) disorders affect roughly 5% of the population. Chronic closed lock is one of the more common temporomandibular disorders and is characterized by limited mouth opening and various degrees of joint pain and dysfunction.

Objectives: To evaluate the efficacy and safety of arthroscopic lysis and lavage of the TMJ to treat limited mouth opening in patients suffering from chronic closed lock.

Methods: This is a retrospective analysis of the medical records of 47 patients with chronic closed lock treated with arthroscopic lysis and lavage. Patients were diagnosed preoperatively with closed lock of the TMJ and were unresponsive to previous conservative therapy. Three outcome variables were used to assess the efficacy of treatment: maximal mouth opening, subjective evaluation of overall improvement by the patient (on a 3 grade scale: “excellent,” “fair,” and “poor”), and length of hospital stay. In addition, complications were reported.

Results: The maximal mouth opening values increased from a mean of 27 ± 4.7 mm preoperatively to a mean of $38 \text{ mm} \pm 5.4$ mm postoperatively. The subjective evaluation of overall improvement was “excellent” in 15 patients (32%), “fair” in 21 (45%), and “poor” in 11 (23%). Success was defined as a maximal mouth opening of 35 mm or more after arthroscopy, and not reporting a “poor” result in the subjective evaluation. This was achieved in 36 patients, yielding a success rate of 77%. The mean length of hospital stay was less than one day (0.78 days). The complication rate was low (8%) and all complications resolved within 2 weeks.

Conclusion: Arthroscopic lysis and lavage is a simple, safe, and efficient minimally invasive intervention for the treatment of chronic closed lock of the TMJ.

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various degrees of pain in the TMJ area [1]. Patients suffering from this disorder complain of a reduction in the quality of life owing to compromised chewing, painful yawning, and other dysfunctional activities due to the limited mouth opening.

Primary treatment of chronic closed lock of the TMJ is often non-surgical, and includes physiotherapy, medication, and occlusal splints [2]. In recalcitrant and chronic cases, surgical intervention is recommended. The two main surgical options for the treatment of chronic closed lock of the TMJ are open joint surgery in the form of arthroplasty and discectomy, or minimally invasive surgery in the form of either arthroscopy or arthrocentesis. Arthroscopy of the TMJ was first described by Ohnishi in 1975 [3,4], many decades after the introduction of arthroscopy in orthopedics [5]. In 1986, Sanders [6] described arthroscopic lysis and lavage as a standardized procedure for the treatment of chronic closed lock of the TMJ. Three decades later, however, this minimally invasive surgical option is still not readily available in most departments of oral and maxillofacial surgery, primarily due to the surgical expertise required and the need for sophisticated armamentarium.

Arthrocentesis of the TMJ was developed as a modification of TMJ arthroscopy. It involves the placement of two hypodermic needles into the upper joint space, which allow irrigation with saline to remove inflammatory cytokines. It was hypothesized that lavage of the joint cavity could be just as successful as arthroscopic mechanical manipulations. Arthrocentesis is a relatively non-invasive procedure with no significant complications. In the authors' department it is the standard treatment for patients suffering from acute closed lock; however, in long-standing cases classified as chronic closed lock, arthrocentesis is generally less effective in treating the condition, and intra-articular manipulations (in the form of arthroscopy or open joint surgery) are required to regain full range of motion. The effect of arthroscopic lysis and lavage lies, in addition to irrigation of the joint cavity and washout of inflammatory cytokines, in mobilization of the articular disk, stretching of the capsule, and direct lysis of intra-articular adhesions [7,8].

Open joint surgery in the form of arthroplasty and discectomy is an acceptable treatment modality for patients suffering from chronic closed lock who were recalcitrant to non-surgical methods. It has a long history in the surgical literature with favorable rates of success. Compared to arthroscopy, however,

Chronic closed lock of the temporomandibular joint (TMJ) is an intra-articular disorder, where the articular disk is displaced anteriorly to the mandibular condyle. This anterior displacement prevents maximal mouth opening and causes

it has the disadvantages of increased morbidity and surgical risk [9-13].

The question of how efficient arthroscopy is in the treatment of chronic closed lock of the TMJ has not been definitively answered. Review of the literature reveals that many studies evaluated various arthroscopic procedures ranging from simple lysis and lavage to advanced operative arthroscopies without differentiation between the different treatments. Many studies did not report clear diagnoses for the study population or differentiate between the different diagnoses and stages when reporting the results [14-19]. The aim of the present study was to evaluate the efficacy of a standardized arthroscopic procedure (arthroscopic lysis and lavage) to treat chronic closed lock of the TMJ.

PATIENTS AND METHODS

This is a retrospective analysis of data from medical records. During a 5 year period (April 2010 to January 2015), 125 patients with various TMJ diagnoses underwent arthroscopic lysis and lavage in the Department of Oral and Maxillofacial Surgery at Sheba Medical Center. Of these patients, 54 were classified as having chronic closed lock of the TMJ and were initially included in the study; 7 did not have sufficient follow-up (minimum of 6 weeks) and were excluded, thus the study population comprised 47 patients. The diagnosis of chronic closed lock was based on preoperative clinical and imaging evaluation and intraoperatively by arthroscopic findings. The preoperative clinical findings were mainly limited mouth opening with or without mandibular deviation to the affected side upon opening, and tenderness in the affected joint during at least one of the following objective examinations: palpation, contralateral movement, contralateral loading of the joint, or actively stretched opening. Unequivocal clinical signs and symptoms were essential for classifying a patient as suffering from chronic closed lock of the TMJ [20,21].

Preoperative imaging consisted of computed tomographic (CT) scans or magnetic resonance imaging (MRI). All images were evaluated by a radiologist who specialized in head and neck radiology. The MRI scans depicted a non-reducing disk displacement, and various degrees of disk deformity were evident. There were mild to moderate degrees of degenerative changes on CT and MRI. All imaging was performed in the few months preceding the operation.

Before advancing to arthroscopy, all patients underwent conservative non-surgical therapy consisting of physiotherapy, splint therapy, or both, and were non-responsive.

One author (W.A.) was involved in all surgical procedures. All arthroscopic procedures were performed under general anesthesia with nasotracheal intubation. One gram of intravenous cefazolin was given shortly after intubation. Procedures were performed using the single- or double-puncture technique.

The superior joint compartment was approached through the inferolateral approach as described by Murakami and Ono [4]. Puncture of the joint cavity was performed as described by McCain et al. [3]. A 30° angle arthroscope (Storz®, Tuttlingen, Germany) with a diameter of 1.9 mm or 2.4 mm was used in all cases. After puncture of the joint cavity, a diagnostic sweep of the superior compartment was performed as described by Sanders [6]. Fluid (saline) outflow was through an 18-gauge needle inserted shortly after insertion of the arthroscope. Double-puncture cases included the insertion of a second (working) cannula. Irrigation with an average of 200 ml of isotonic saline solution was performed under 40 to 60 kPa pressure. Adhesions were lysed directly by the arthroscope or a blunt trocar.

Immediate postoperative mobilization of the jaw was initiated on the day of the operation. The patients performed self-stretching exercises for a minimum of 4 weeks. The second phase of physiotherapy was started roughly 1 month after surgery and consisted of guided physiotherapy by a professional physiotherapist. The course usually consisted of 6 to 10 weekly sessions.

The medical records of the patients included a measurement of maximal mouth opening (MMO) at every visit to the clinic, before and after arthroscopy. The average and range of MMO in the study population was calculated. A comparison of the pre- and postoperative MMO values was performed to evaluate the efficacy of treatment. The MMO measurement at the last follow-up evaluation available for each patient was considered to be the postoperative value. MMO was considered the primary outcome variable. The patient's subjective evaluation of overall improvement after treatment was the secondary outcome variable. It was determined by drawing the patient's verbal self-reported subjective experience from the medical records at the last two follow-up appointments. The patient's reports were classified according to a 3 grade scale: "excellent" if the patient clearly stated that there was no pain or dysfunction during eating or yawning or other daily activities; "fair" if the patient reported improvement relative to the pre-treatment condition despite some residual pain or dysfunction of some sort. Joint noises were not regarded as a dysfunction. "Poor" was noted if the patient expressed no change after treatment or, alternatively, worsening of pain or function after arthroscopy. The third outcome variable was the length of hospital stay. The average and range of length of hospital stay for the study population was calculated. Finally, adverse events were documented and reported.

STATISTICAL ANALYSIS

Paired *t*-test was used to compare the MMO before and after arthroscopy, *t*-tests to test the difference between genders and complications (with vs. without), and Fischer's exact test to evaluate the association between gender and complications.

The study was approved by the institutional ethical review board. The study conformed to guidelines of the Declaration of Helsinki.

RESULTS

Forty-seven patients were included in the study. The mean age of the study population was 32 years (range 14–66 years). Thirty-eight patients (80%) were female and 9 (20%) were male. The mean duration of symptoms before arthroscopy was 20 ± 14 months. The average postoperative follow-up after arthroscopy was 5 months, and the longest was 24 months. The minimal postoperative follow-up for inclusion in the study was 1.5 months [Table 1].

Forty-two patients (89%) achieved greater MMO values after arthroscopy, and the mean MMO for the whole study population increased from 27 ± 4.7 mm (range 18–34 mm) preoperatively to 38 ± 5.4 mm (range 30–55 mm) postoperatively (*P* < 0.0001). The minimal functionally satisfactory mouth opening in healthy individuals is 35 mm. Before arthroscopy, none of the patients had a satisfactory functional MMO, whereas after arthroscopy 38 patients (80%) achieved the satisfactory functional MMO of 35 mm or more [Table 2].

The secondary outcome variable was the patient’s self-reported subjective evaluation of overall improvement after treatment. Fifteen patients (32%) denied experiencing any pain or dysfunction at the last two follow-up examinations and were consequently classified as having an “excellent” result. Twenty-one patients (45%) reported having some degree of pain or dysfunction, however, to a lesser extent than before arthroscopy. These patients were classified as having a “fair” result. Eleven patients (23%) were considered to have a “poor” result after reporting a feeling of no improvement after treatment at the last two follow-up examinations, and in 2 cases, even worsening.

Success was defined as achieving an MMO of 35 mm or more, and reporting an “excellent or “fair” result after arthroscopy. The two conditions were achieved in 36 patients, yielding a success rate of 77%.

Thirty-five patients (74%) were discharged from hospitalization in the department the day after arthroscopy (admission for 1 day), and 12 patients (26%) were discharged on the same day of arthroscopy. The average hospital stay for the study population was less than 1 day (0.78 days).

The complication rate was low (8%, 4 patients). Two patients suffered from paresis of the temporal branch of the facial nerve, which in both cases resolved completely within 3 days. One patient complained of dizziness and earache. Otolaryngological examination did not demonstrate any abnormal findings, and the condition resolved completely within 2 weeks. One patient suffered from periorbital edema due to fluid extravasage during the procedure. There was complete resolution within a few days, with no residual esthetic deficit.

No statistical significant differences were found between female and male patients with regard to age, duration of symptoms, and treatment outcome. No correlations were found between the success of treatment and gender, age, and length of hospital stay.

DISCUSSION

The present study found arthroscopic lysis and lavage to be a safe and effective minimally invasive intervention for the treatment of chronic closed lock of the temporomandibular joint. The majority of patients achieved a satisfactory functional mouth opening of 35 mm or more postoperatively and reported a subjective feeling of improvement after arthroscopy. Similar results were demonstrated in studies evaluating open joint surgery for the treatment of chronic closed lock [22,23]. Taking into account the significantly lower morbidity and complication rate [9-13], arthroscopy is clearly the preferred surgical option over open arthrotomy.

The two main advantages of this study are the specific joint pathologies included (e.g., chronic closed lock) and the uniformity of the surgical procedure (a standardized arthroscopic lysis and lavage performed by one surgeon). A review of the literature shows that many studies lack clear diagnoses of the TMJ disorders included, or lack differentiation between the different diagnoses and stages when reporting treatment outcomes [14-19]. There are different types of intracapsular TMJ disorders that are so different in diagnosis and treatment they should not be lumped together when reporting the treatment results. TMJ surgical outcomes should be reported by the specific category of TMJ disorder [24]. Another issue is the lack of uniformity of the surgical procedure performed. Many studies evaluated various procedures ranging from simple arthroscopic lysis and lavage to the more advanced operative arthroscopy, and the results were not stratified separately according to the efficacy of each surgical intervention [14-19]. Moreover, when different surgical techniques were evaluated

Table 1. Description of the study population

Age (years)	Mean: 32 Range: 14–66
Female to male ratio	38 : 9 (-4 : 1)
Duration of symptoms before arthroscopy	20 ± 14 months
Postoperative follow-up	5 ± 4 months

Table 2. Maximal mouth opening (primary outcome variable)

	Before arthroscopy	After arthroscopy
Maximal mouth opening (mean ± SD)	27 ± 4.7 mm	38 ± 5.4 mm
Percentage of patients with mouth opening of > 35 mm	0	80%

for the treatment of the same entity, assessment of randomization was lacking.

The mean length of hospital stay for the study population was less than 1 day. This further shows that arthroscopic lysis and lavage is a simple, effective and safe method for treating chronic closed lock of the TMJ. The authors recommend that when non-surgical therapy fails to ameliorate the signs and symptoms of the disorder, arthroscopic lysis and lavage should be used.

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