

Treatment of Intermittent Locking of the Jaw in Wilkes Stage II Derangement by Arthroscopic Lysis and Lavage

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Purpose: This study evaluated the efficacy of a standardized arthroscopic lysis and lavage in decreasing the intermittent locking and transient pain episodes that characterize patients with early- to intermediate-stage internal derangement (Wilkes stage II).

Patients and Methods: This is a retrospective analysis of the medical records of 27 patients (39 joints) treated by arthroscopic lysis and lavage in the authors' department during a 2.5-year period. Patients were diagnosed preoperatively as having mild internal derangement (Wilkes stage II) that was unresponsive to previous conservative therapy. Three outcome variables were used to assess the efficacy of treatment: 1) frequency of intermittent locking or catching episodes, 2) severity of pain, and 3) maximal interincisal opening.

Results: Ninety-two percent of patients reported improvement regarding the locking and catching episodes. Most patients (77%) denied experiencing any locking episodes during the follow-up period, and 15% reported experiencing locking episodes but with less frequency or severity. The median duration of symptoms for patients who were freed from locking episodes was 16 months compared with 36 months for patients who still had locking episodes after treatment ($P = .059$). Mean pain values (visual analog scale, 0 to 10) decreased from 7.5 preoperatively to 3.2 postoperatively ($P < .0001$). For maximal interincisal opening, there was no significant difference after treatment (mean, 39.4 mm preoperatively vs 41.3 mm postoperatively; $P = .06$). Success was defined as a decrease in locking episodes, a decrease of pain, and maintenance of normal interincisal opening (>36 mm). The overall success rate was 81.4% (22 of 27 patients).

Conclusion: Arthroscopic lysis and lavage is an efficient treatment modality for treating mild internal derangement of the temporomandibular joint. It decreases the frequency of locking episodes and decreases transient pain periods.

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Mild internal derangement of the temporomandibular joint (TMJ; Wilkes stage II) is characterized by normal or close-to-normal range of motion interrupted by episodes of jaw locking or catching and painful clicking. These episodes are intermittent and transient. At this stage, there is no limitation in mouth opening or function except during the locking or pain episodes. One of the main complaints of patients is a decrease in quality of life owing to intermittent locking and transient

pain. In his original article, Wilkes¹ classified this condition as early- to intermediate-stage internal derangement (stage II).

The question of how efficient arthroscopic lysis and lavage in the treatment of the initial stages of internal derangement has not been answered definitively.²⁻⁴ Most studies evaluated patients with advanced stages of internal derangement, namely chronic closed lock (Wilkes stage IV) and derangement with

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degenerative changes (Wilkes stage V).⁵⁻²¹ Many studies evaluated various arthroscopic procedures ranging from simple lysis and lavage to advanced operative arthroscopies without differentiation between the different treatments.²²⁻³¹ Many studies did not report clear diagnoses for the study population or did not differentiate between the different diagnoses and stages when reporting the results.²²⁻³⁰ To the authors' knowledge, there are only 5 studies in the literature that specifically evaluated the efficacy of arthroscopic lysis and lavage to treat the initial stages of internal derangement, namely Wilkes stage II.³²⁻³⁶ None of these studies addressed the issue of intermittent locking episodes.

This study evaluated the efficacy of a specific arthroscopic procedure (arthroscopic lysis and lavage) in the treatment of early-to intermediate-stage internal derangement (Wilkes stage II only). Patients should be evaluated primarily for elimination of intermittent locking episodes and decrease of transient pain. At this stage, usually there is no constant limitation in mouth opening.

Patients and Methods

This is a retrospective analysis of data from medical records. During a 2.5-year period (April 2010 to September 2013), 65 patients with various TMJ diagnoses underwent arthroscopic lysis and lavage in the authors' department. Of these, 27 patients were classified as having mild internal derangement (Wilkes stage II) and were included in the study. Patients with bilateral involvement who had a diagnosis of Wilkes stage III, IV, or V on 1 side were not included in the study.

Classification according to the Wilkes criteria was based on preoperative clinical and imaging evaluation and intraoperatively by arthroscopic findings. The preoperative clinical findings of patients with stage II were mainly clicking and beginning transient locking or catching episodes accompanied by pain. These locking episodes lasted seconds to minutes to hours and were released spontaneously or by jaw manipulation by the patient. Clinically, patients with Wilkes stage II derangement were distinguished from those with stage III derangement in that the latter presented with locking episodes that lasted for days to weeks, and usually their mouth opening did not reach normalcy between locking episodes. As a guide for proper clinical differential, stage III internal derangement was considered a subacute closed lock that intermittently opened or acute closed lock.

Preoperative imaging consisted of computerized tomographic (CT) scans or magnetic resonance (MR) imaging. All images were evaluated by a radiologist who specialized in head and neck radiology. The MR scans depicted a reducing disc displacement, and in

some cases mild disc deformity was observed. There were no signs of degeneration (narrowing of joint cavity, flattening of articular surfaces, subchondral sclerosis, osteophytes, etc). MR examinations included at least closed- and open-mouth proton density-weighted images in the sagittal oblique plane, closed-mouth T1-weighted images in the true coronal plane, and closed-mouth T2-weighted images in the axial plane. All images were obtained in a 3-mm section thickness. CT scans were performed in the axial plane with a slice no thicker than of 1.2 mm and reformatted sagittal oblique and coronal planes. Open- and closed-mouth positions were obtained. Similar to MR images, none of the CT scans visualized any signs of degeneration. All imaging (CT and MR) was performed in the few months preceding the operation.

Intraoperative arthroscopic findings of the study population were consistent with mild internal derangement of the joint. None of the patients were excluded from the study group after arthroscopic evaluation. The findings consisted of normal synovium with mild degrees of hyperemia and hypervascularity. Mild retrodiscal synovial redundancy was observed in some cases. In the open-mouth position, the roofing of the condyle by the disc was in the range of 100%, producing the characteristic "white-on-white appearance," whereas in the closed-mouth position, the roofing was decreased. Three cases exhibited fine adhesions in the anterior recess. The shape and texture of the disc were normal in all cases. There were no signs of chondromalacia or subchondral bone exposure in any of the cases.

The medical records contained the following information: measurement of maximal interincisal opening (MIO), a subjective evaluation of pain by a visual analog scale (VAS) ranging from 0 to 10, and a verbal evaluation of the frequency and severity of the locking or catching episodes. All patients were asked verbal questions regarding the frequency and severity of the locks. Patients rated the frequency of their locking episodes preoperatively as occurring on a daily, weekly, or monthly basis and rated the severity of the locking episodes as lasting for seconds, minutes, hours, or days. At the follow-up evaluations, patients were asked whether they experienced any locking episodes since treatment and, if so, whether the frequency and severity of the locks were less than, similar to, or worse than preoperatively. To evaluate the efficacy of treatment, the preoperative and postoperative values were compared. The follow-up evaluation conducted at approximately 6 months postoperatively was used to evaluate the response to treatment. The evaluations were performed by the same surgeons performing the operations.

Before advancing to arthroscopy, all patients underwent conservative nonsurgical therapy consisting of

rest (soft diet, avoiding parafunctional habits, education, etc) for a period of at least 3 months and pharmacotherapy (nonsteroidal anti-inflammatory drugs [NSAIDs] with or without diazepam or clonazepam) for at least 2 weeks. In addition, 8 patients received splint therapy for a period ranging from 1 month to 4 years, and 20 patients underwent at least 1 course of physiotherapy (consisting of a minimum of 6 weekly sessions). One patient underwent all 4 nonsurgical treatment modalities. The period of nonsurgical therapy lasted from 3 months to 4 years, but the treatment modalities were not used continuously. Only patients who did not benefit from conservative therapy while under follow-up (minimum, 3 months) or showed no tendency toward improvement and denied satisfactory improvement after such therapy in the past were advanced to surgical methods.

All surgical procedures were performed by the 2 main surgeons (W.A. and N.G.). All procedures were performed under general anesthesia with nasoendotracheal intubation. Intravenous Cefamezin 1 g (Panpharma, France) was given shortly after intubation. All procedures were performed by a single-puncture technique. The superior joint compartment was approached through the inferolateral approach as described by Murakami and Ono.³⁷ Puncture of the joint cavity was performed as described by McCain et al.^{38,39} A 1.9-mm 30° angle arthroscope (Storz, Tuttlingen, Germany) was used in all cases. After puncture of the joint cavity, a diagnostic sweep of the superior compartment was performed as described by Sanders.²¹ Fluid (saline) outflow was through an 18-gauge needle inserted shortly after the insertion of the arthroscope. Irrigation with an average of 200 mL of isotonic saline solution was performed under 50- to 60-kPa pressure. In the few cases in which adhesions were found, adhesiolysis was performed directly by the arthroscope, blindly by the blunt trocar, or by the 18-gauge outflow needle. No intra-articular medication was injected.

Postoperative supportive treatment consisted of 3 treatment modalities: NSAIDs, physiotherapy, and a soft diet. NSAIDs were started the day of surgery and were continued for 1 to 2 weeks. Naproxen 1 g or ibuprofen 800 mg was the usual daily dosage. Physical therapy started 1 to 2 days postoperatively for a period of 1 to 2 months. Therapy started in the form of stretching mouth-opening exercises using stacked wooden tongue blades the day after surgery and continued for approximately 2 weeks. After the second week, patients began a course of guided physiotherapy with a physiotherapist. The aim of this phase of treatment was maintenance of pain-free full range of motion, mobilization, and muscle strengthening by isometric exercises. The course usually consisted of 6 weekly sessions. The patients were requested to eat a soft diet during the course of physiotherapy. The rationale behind a no-chewing diet is

unloading of the joint during the rehabilitation period. No other conservative measures were used during the postoperative period. All postoperative measures ended approximately 8 weeks after surgery.

STATISTICAL ANALYSIS

All statistical analyses were performed using StatsDirect 2.8.0 (Statsdirect Ltd, Altrincham, UK). Data are presented as mean \pm standard deviation or median and interquartile range where appropriate. Comparison of continuous parameters was performed by *t* test or by paired *t* test for comparisons of before and after arthroscopic intervention or by the equivalent nonparametric test when data were not normally distributed. Comparison of proportions was performed by χ^2 or Fisher exact test. In all analyses a *P* value less than .05 was considered significant.

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

Results

Twenty-seven patients were included in the study. The mean age of the study population was 25 years (range, 16 to 53 yr). Eighteen patients (67%) were female and 9 (33%) were male. Of the 27 patients who comprised the study population, 12 (44%) had bilateral involvement (39 joints). The median duration of symptoms before arthroscopy was 18 months (range, 4 to 96 months) and the mean follow-up time after arthroscopy was 18 months (range, 6 to 36 months). Table 1 presents a description of the study population.

The mean preoperative MIO was 39.4 ± 6.6 mm. The mean preoperative VAS score was 7.5 ± 1.3 . All patients (100%) had intermittent locking and catching episodes before arthroscopy. Table 2 presents baseline values of the study population.

Table 1. DESCRIPTION OF STUDY POPULATION

Gender, n (%)	
Women	18 (67)
Men	9 (33)
Age (yr), mean (range)	25 (16-53)
Laterality, n (%)	
Unilateral	15 (56)
Bilateral	12 (44)
Duration of symptoms (yr), n	
<1	5
1-2	13
>2	9

Table 2. BASELINE VALUES OF STUDY POPULATION (PRETREATMENT VALUES)

Maximal interincisal opening (mm), mean ± SD	39.4 ± 6.6
Pain (VAS 0-10), mean ± SD	7.5 ± 1.3.
Locking episodes (frequency), % (n)	
Daily occurrence	70 (19)
Weekly occurrence	26 (7)
Monthly occurrence	4 (1)
Locking episodes (severity), % (n/N)	
Last for seconds	19 (5/27)
Last for minutes	59 (16/27)
Last for hours	22 (6/27)

Abbreviations: SD, standard deviation; VAS, visual analog scale.

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A comparison of the preoperative and 6-month postoperative values was performed for the 3 outcome variables (locking episodes, pain according to the VAS, and MIO). The results are listed in Table 3.

Most patients denied experiencing any locking episodes after treatment (77%; 21 of 27). Of the other 6 patients who did experience locking episodes, 4 patients (15%) reported experiencing locking episodes, but with less frequency or severity than preoperatively and 2 patients (8%) reported no improvement with regard to locking episodes after treatment (Table 4). The decrease in locking episodes was found to be statistically significant ($P < .0001$). None of the patients reported worsening of the locking episodes.

The median duration of symptoms for the entire study population was 18 months (range, 4 to 96 months). The median duration of symptoms for patients who were freed of locking episodes after treatment was 16 months (range, 6 to 60 months). The median duration of symptoms for patients who had only partial improvement or no improvement at all was 36 months (range, 4 to 96 months). This difference

Table 3. TREATMENT OUTCOMES

	Before Treatment	After Arthroscopy	P Value
Locking episodes, % patients	100	23	<.0001
Pain (VAS), mean ± SD	7.5 ± 1.3	3.2 ± 2.4	<.0001
MIO (mm), mean ± SD	39.4 ± 6.6	41.3 ± 5.2	.06

Abbreviations: MIO, maximal interincisal opening; SD, standard deviation; VAS, visual analog scale.

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(16 vs 36 months) was only borderline statistically significant ($P = .059$). When including only the 18 patients whose duration of symptoms was up to 2 years, 17 patients (94%) reported no locking episodes during the entire follow-up period.

The mean pretreatment VAS score was 7.5 ± 1.3 . The mean 6-months postoperative VAS score was 3.2 ± 2.4 . The decrease was statistically significant ($P < .0001$). At the 6-month postoperative follow-up, most patients (93%; 25 of 27) reported lower VAS levels of pain, and the average decrease in VAS values was 57%. Seventeen patients (63%) had VAS values lower than 3. Two patients reported unchanged pain values. At the 1-year follow up, a further decrease in pain levels was evident, but these data were available only for 12 patients and thus were not included in the statistical analysis.

MIO did not change statistically after arthroscopy. No statistical increase in mouth opening was observed at any time during the follow-up period. The mean preoperative MIO was 39.4 ± 6.6 mm, the mean postoperative value was 41.3 ± 5.2 mm, and the difference was not significant statistically ($P = .06$). Twenty-one of 27 patients had an MIO of at least 36 mm preoperatively, and almost all (25 of 27) had an MIO of at least 36 mm postoperatively.

Success was defined as an improvement in all 3 outcome variables: a decrease in locking episodes, a decrease of pain (VAS), and an MIO of at least 36 mm. The success rate was 81.4% (22 of 27 patients).

No statistical differences were found between female and male patients with respect to age, duration of symptoms, treatment outcome, and overall success rate. There were no serious surgical complications for any of the patients.

Discussion

The present study found arthroscopic lysis and lavage to be effective in decreasing and even eliminating the intermittent locking episodes and transient pain that characterize patients with mild stages of internal derangement. The authors found that shorter durations of symptoms before arthroscopy correlated with better outcomes. Although the last finding was only borderline statistically meaningful, it means that even when patients do not deteriorate into more advanced stages of derangement with time, the chronicity actually has a negative effect on the ability of arthroscopy to reverse the condition. When evaluating only patients whose duration of symptoms was shorter than 2 years, the efficacy of arthroscopic lysis and lavage in eliminating the locking and catching episodes was as high as 94%. There are few reports in the literature that have addressed the issue of early versus late intervention for internal derangement of

Table 4. LOCKING EPISODES BEFORE AND AFTER ARTHROSCOPY

	Patients With Locks, n	Daily Occurrence, %	Weekly Occurrence, %	Monthly Occurrence, %
Before arthroscopy	27	70	26	4
After arthroscopy	6	33.3	0	66.6

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the TMJ. Machoň et al⁴⁰ evaluated the efficacy of arthroscopic lysis and lavage in treating patients with chronic closed lock and found that patients with a shorter duration of symptoms benefited more than those with a longer duration. Israel et al⁴¹ evaluated the efficacy of operative arthroscopy in treating patients with advanced stages of derangement and found better results for patients with shorter periods of symptoms before arthroscopy. Indresano² hypothesized that lysis and lavage can reverse the problem when it is caught early, and that operative arthroscopy is required for prolonged advanced stages of the disease. Other researchers also suggested that management and treatment of internal derangement is more effective during the early stages of the disease.³²

Review of the literature on arthroscopic lysis and lavage of the TMJ shows that most studies evaluated patients with advanced stages of internal derangement, namely chronic closed lock (corresponding to Wilkes stage IV) and derangement with degenerative changes (corresponding to Wilkes stage V).⁵⁻²¹ Based on these studies, it is well-established that arthroscopic lysis and lavage is an effective treatment modality for advanced stages of internal derangement (stages IV and V). To the authors' knowledge, there are only 5 studies in the literature that evaluated the efficacy of arthroscopic lysis and lavage in treating specifically mild internal derangement of the TMJ, namely Wilkes stage II.³²⁻³⁶ Bronstein and Merrill³² found that patients with Wilkes stage II internal derangement benefited the most from arthroscopy. These patients in the early to intermediate stage had excellent results in 94% of cases. The success rate decreased with advanced stages. Smolka and Iizuka³³ and Smolka et al³⁴ found similar results. They evaluated the effect of a standardized arthroscopic lysis and lavage in treating different stages of internal derangement. Each stage of derangement was evaluated separately. They found better outcomes for earlier stages of derangement than for more advanced stages and reported a success rate of 80 to 90% for stage II internal derangement. Smolka and Iizuka³³ and Smolka et al³⁴ further addressed the issue of locking episodes and reported a decrease in locks for the study population. González-García and Rodríguez-Campo³⁵ evaluated patients with different stages of derangement separately and compared the results according to stage (Wilkes) and the arthroscopic

procedure performed (arthroscopic lysis and lavage vs operative arthroscopy). They found, among other findings, arthroscopic lysis and lavage to be efficient in decreasing pain in patients with stage II derangement. Mouth opening for patients with Wilkes stage II derangement was within normal limits preoperatively, and it was maintained after arthroscopy. Weedon et al³⁶ found that patients with lower Wilkes stages showed the greatest improvement in pain score after arthroscopic lysis and lavage. In addition, they found greater improvement in interincisal opening among lower Wilkes stages compared with advanced stages, although this was not statistically meaningful.

There are 3 additional studies in the literature that evaluated the efficacy of arthroscopic lysis and lavage in treating mild internal derangement; however, the diagnoses were described without using the Wilkes classification.⁴²⁻⁴⁴ These studies reported somewhat different results than the 5 articles mentioned earlier. Nitzan et al⁴² evaluated patients with disc displacement with reduction (representing stage II and probably some stage III derangements) and disc displacement without reduction (representing Wilkes stage III to IV derangement). They found that patients with early derangement conditions (reducing disc displacements) benefited less from arthroscopic lysis and lavage than those with more advanced stages. Only 1 of 5 patients with reducing disc displacement showed improvement after arthroscopy. Indresano⁴³ evaluated the efficiency of arthroscopic lysis and lavage in the treatment of patients with a diagnosis of reducing disc displacement with pain, clicking, and some hypomobility (probably representing Wilkes stages II and III) and patients with closed lock (probably representing Wilkes stages III to IV). The success rate was only 50% for the group of patients with reducing disc displacements, much lower than the success rate for the more advanced stages of disease. Montgomery et al⁴⁴ found arthroscopic lysis and lavage to be equally effective for treating disc displacement with reduction and disc displacement without reduction. They further addressed the issue of locking episodes and reported the elimination of this symptom for the entire study population.

There are 2 main strengths of this study: the specific joint pathologies included (eg, derangement stage II only) and the uniformity of the surgical procedure (eg, a standardized arthroscopic lysis and lavage

performed by 2 surgeons only). Review of the literature shows that many studies lack clear diagnoses of the temporomandibular disorders included or lack differentiation between the different diagnoses and stages when reporting treatment outcomes.²²⁻³⁰ There are different types of intracapsular TMJ disorders that are so different in diagnosis and treatment that they should not be lumped together when reporting the treatment results. TMJ surgical outcomes should be reported by the specific category of TMJ disorder.⁴ Another issue is the lack of uniformity to 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.²²⁻³¹ Moreover, when different surgical techniques were evaluated for the treatment of the same entity, assessment of randomization was lacking.

The authors found that the effects of arthroscopic lysis and lavage for mild internal derangement are evident as soon as 2 to 3 months postoperatively, and the 6-month postoperative evaluation provides a reliable impression on the efficacy of treatment. All patients were evaluated 6 months after arthroscopy, and none were lost to follow-up. The 1-year follow up was available only for 12 of the patients and showed a further decrease in pain levels. The authors assume that if the 1-year follow-up examination had been available for the entire study population, this would have added strength to the results. Conversely, reports of long-term results (many years) are less reliable, primarily owing to the increasing number of patients lost to follow-up. Other factors that compromise the accuracy of reporting long-term results include the presence or absence of parafunctional habits,⁴ the psychosocial status of patients, and the nature of the temporomandibular diseases that many times fluctuate with time.

There were no complications from the arthroscopic intervention in this study group. This is consistent with many large-scale studies in the literature that found a low complication rate after TMJ arthroscopy.^{27,45-49}

This study showed that simple arthroscopic lysis and lavage is an effective and safe method for treating mild internal derangement of the TMJ. It decreases intermittent locking and catching of the jaw and decreases transient pain episodes. The authors recommend that when nonsurgical therapy fails to show a tendency toward improvement in the signs and symptoms of the disorder, arthroscopic lysis and lavage should be used.

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