

Efficacy of Manipulation under Anesthesia for Patients with Adhesive Capsulitis: A Systematic Review

Best J^{1*}, Padela M², Baldawi M², Hasnain M² and Saleh K²

¹College of Osteopathic Medicine, Michigan State University, USA

²Department of Orthopedic Surgery, John D. Dingell VA Medical Center, USA.

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ABSTRACT

Background: Manipulation under anesthesia (MUA) is an orthopedic procedure which can benefit patients with musculoskeletal pathologies. This review article analyzes the efficacy of manipulation under anesthesia based on existing literature. Pain, range of motion, strength, ability to carry out activities of daily living and likelihood of refilling an opioid prescription has been examined.

Methods: The literature review was carried out using PubMed database and Colwiz software was utilized as a reference manager. Initial literature review showed a total of 6,240 articles. After screening for duplicates and excluding abstracts not relevant to our inquiry, a total of 19 studies were selected for full article review. Finally, a total of 8 articles met our inclusion criteria and were included in this review.

Results: Five articles in this review studied the effects of MUA on adhesive capsulitis in otherwise healthy patients using Constant-Murley and adjusted Constant-Murley scores. Two articles specifically studied the effects of MUA on adhesive capsulitis in diabetic patients using Oxford and adjusted Constant-Murley scores. Lastly, one paper examined the effects of MUA on the likelihood of refilling an opioid prescription.

Conclusion: This paper proves that MUA is an efficacious technique for treatment of adhesive capsulitis and reducing the likelihood of refilling an opioid prescription. Although we recommend additional studies to further prove its efficacy, we believe that this procedure holds invaluable benefits for patients.

Keywords: Manipulation, Anesthesia, Adhesive capsulitis, Orthopedic procedure

INTRODUCTION

Manipulation under Anesthesia (MUA) is an orthopedic procedure that has been in practice since the 1930s. However, not much is known about the actual efficacy of this treatment. The procedure fell out of popular use in the 1950s due to complications from the anesthesia typically used at the time, but was revived in the 1990s when safer agents were beginning to be utilized [1]. Today, MUA is used as an alternative for patients suffering from musculoskeletal ailments that have failed surgery or conservative measures such as physical therapy and pharmacotherapy. Additional patient qualifications for MUA include those who have experienced orthopedic trauma or surgery and have experienced excessive scar tissue build up either as a direct result of invasion or from decreased use of the joint itself. MUA involves sedating the patient with general anesthesia, followed by articular and soft tissue mobilization. The movement is carried out in a specified arc of motion until an audible sound of the adhesions breaking is heard. This procedure is chosen not to be carried out in conscious patients due to the possibility of eliciting pain or

muscle spasms. The primary aims of MUA are to restore patient mobility and strength, to relieve pain in symptomatic patients and to break up scar tissue, thus decreasing inflammation and increasing range of motion. The procedure can be carried out by a trained and licensed chiropractor, physician, or surgeon in either an inpatient or outpatient setting in the United States. Additionally, new research has shown that orthopedic manipulation may lead to a reduced incidence of refilling a prescription for an opioid analgesic [2]. A well-known crisis in medicine today is the opioid epidemic that has become widespread throughout the United

Corresponding author: Jacob Best, MS, College of Osteopathic Medicine, Michigan State University, 415 E Maryland Avenue, Royal Oak, MI 48067, USA, Tel: (248)-688-7227; E-mail: bestjaco@msu.edu

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States. This paper may shed light on a revolutionary way to help decrease prescription opioid use in America and will be briefly discussed in this paper.

Although MUA is often used in practice in the United States, little research has been done to broadly examine the efficacy of this treatment. This review was carried out to provide an in-depth analysis of patient reported outcomes both pre- and post-MUA based on the available literature. By analyzing multiple studies, our aim was to reveal the benefits of MUA by looking at patient outcomes such as active range of motion, pain scores, muscle strength and improvement in activities in daily living after receiving this treatment.

METHODS

A literature review was carried out by utilizing the PubMed database using the search terms found in **Table 1**. All articles were searched and obtained through the Michigan State University library website. The Preferred Reporting Items and Systematic Reviews (PRISMA) 2009 checklist was used as a reference to carry out this review. The article on prescription opioids was selected individually and specifically separate from the primary literature review.

Table 1. Overview of included studies.

Study	Journal	Study design	Number of joints	Mean follow-up
First author (year)	What is the journal?	Retrospective/prospective study or randomized clinical trial?	How many joints included in the study (sample size)?	Mean time of follow-up in days or months
Whedon et al. [2]	Journal of Alternative and Complementary Medicine	Retrospective study	N/A	N/A
Dodenhoff et al. [3]	Journal of Shoulder and Elbow Surgery	Prospective study	39 shoulders	11 months
Othman and Taylor [4]	International Orthopedics	Prospective study	80 shoulders	33.4 months (late follow-up)
Wang et al. [5]	International Orthopedics	Retrospective study	51 shoulders	N/A
Ahmad et al. [6]	Journal of College of Physicians and Surgeons Pakistan	Prospective study	30 shoulders	N/A
Jenkins et al. [7]	Journal of Shoulder and Elbow Surgery	Retrospective study	292 shoulders	N/A
Wang et al. [8]	International Orthopedics	Retrospective study	63 shoulders	N/A

A total of 19 articles were selected after initial title and abstract review. All articles collected were organized using a reference manager. After applying the inclusion and exclusion criteria, a total of 8 articles were chosen to be used for this manuscript. Inclusion criteria included studies that were measuring changes in range of motion, pain scores, muscle strength, and activities of living as a result of MUA. Articles that were not included in this paper either were observing factors that were not in the scope of this study or only mentioned the use of MUA without mentioning its efficacy as a treatment.

BENEFITS OF MUA ON ADHESIVE CAPSULITIS

Multiple studies in the literature have provided data showing that MUA can have a significant impact on active range of motion in patients after receiving MUA. Often following trauma or surgery, reduced usage of a certain joint can lead to the buildup of scar tissue over time, limiting the range through which a patient can move freely and without pain. Consequently, decreased usage of the muscles leads to atrophy and weakness over time.

Several articles specifically studied the effects of MUA on patients with adhesive capsulitis, also known as frozen shoulder. Frozen shoulder has been categorized as a self-limiting illness; however the condition can cause pain in

patients and limit their range of motion. MUA is being studied specifically as a measure of treatment that may limit the duration of the disease and may even improve outcomes at the end of treatment. Dodenhoff et al. [3] preferred to classify frozen shoulder into two categories: primary and secondary. Primary frozen shoulder describes patients, who have not experienced any event other than a general loss of movement, and secondary frozen shoulder applies to patients who are experiencing post-traumatic stiffness or have symptoms related to diabetes mellitus, post-myocardial infarction pain and inflammatory disorders [3]. Shoulder recovery and improvement following MUA can be measured with the Constant-Murley shoulder score. This score system is a 100-point scale containing parameters that define the level of pain and the ability to carry out normal daily activities for a patient [1]. The test is divided into four subscales: pain (15 points), activities of daily living (20 points), strength (25 points) and range of motion in forward elevation (flexion), external rotation, abduction, and internal rotation of the shoulder (40 points). Higher patient score is correlated with a greater quality of function at the shoulder joint. Several studies cited in this review utilize the Constant-Murley score to assess progress in a patient post-MUA. Dodenhoff et al. [3] prospectively assessed 39 shoulders in 37 patients diagnosed with primary frozen shoulder. The Constant-Murley shoulder score was implemented and found in their results an average of 24 points pre-MUA, 63 points at 3-6 weeks follow-up, 69 points at 3 months follow-up and 73 points at follow-ups greater than 6 months (all values were statistically significant, $p < 0.01$) [3]. Additionally, 89% of patients were reported to be satisfied with the results of MUA after 6 months follow-up [3]. The authors view MUA as a simple, well-tolerated procedure with a high patient satisfaction and a low complication rate and recommended its use in reducing the duration of morbidity from frozen shoulders [3]. Othman and Taylor [4] conducted a study looking at 74 frozen shoulders both pre- and post-MUA using an adjusted Constant-Murley score by excluding the abduction strength measurement, thus creating a maximum score of 75. The researchers chose to do this as measurement of abduction strength is difficult, especially since most patients with frozen shoulder cannot abduct their arm to 90 [4]. Measuring abduction strength may result in falsely lower Constant-Murley scores [4]. The average score for observed patients was 24.7 points pre-MUA, 54.9 points at 3 weeks follow-up, and 72.4 points at 33 months follow up [4]. The authors believe that manipulation does speed up recovery from frozen shoulder and that this recovery is maintained [4]. Wang et al. [5] evaluated 47 cases with 51 frozen shoulders using an adjusted Constant score excluding muscle strength for a maximum score of 75. The averages for the Constant scores were as follows: 22.8 ± 4.9 (10-31) pre-MUA, 52.6 ± 9.2 (31-67) at 3 weeks follow-up and 70.1 ± 6.2 (54-75) at 82 months follow-up with 23 shoulders scoring a maximum of 75 points [5]. The authors agree that MUA is a simple and

non-invasive procedure that can be used for reducing the course of frozen shoulders and improving shoulder function and symptoms efficiently [5].

Using the Constant-Murley score is not necessary to evaluate the effectiveness of MUA on frozen shoulders. More traditional methods of measuring range of motion, pain and strength can be used. Ahmad et al. [6] observed the immediate outcome of MUA in 30 cases with adhesive capsulitis in terms of gain of range of movement (ROM). Range of motion in patients was measured with a goniometer. External rotation increased from $1.133^\circ \pm 0.345^\circ$ before MUA to $2.06^\circ \pm 0.868^\circ$ after MUA ($p < 0.001$) [6]. Medial rotation increased from $1.366^\circ \pm 0.490^\circ$ before MUA to $2.766^\circ \pm 0.897^\circ$ after MUA ($p < 0.001$). Flexion increased from $1.833^\circ \pm 0.746^\circ$ before MUA to $3.400^\circ \pm 0.674^\circ$ after MUA ($p < 0.001$). Abduction increased from $2.266^\circ \pm 0.639^\circ$ before MUA to $3.433^\circ \pm 0.817^\circ$ after MUA ($p < 0.001$) [6]. External rotation was the least improved, however it is noteworthy to see that in every case patients had a significant improvement in range of motion. A significant decrease in pain intensity, 3.667 ± 0.808 before MUA and 2.10 ± 1.02 after MUA, was appreciated using a numerical pain scale ($p < 0.001$) [6].

MUA IN DIABETIC PATIENTS WITH ADHESIVE CAPSULITIS

Diabetes mellitus is a systemic condition characterized by a sharp increase in blood glucose, leading to damage to many different areas of the body including the musculoskeletal system. The incidence of frozen shoulder in the diabetic population is 10-36% compared to 2-5% in the general population [7]. Additionally, frozen shoulder has a more severe course in diabetic patients. Therefore, we must identify treatment options for these patients as they tend to respond less well to conservative treatment. Jenkins et al. [7] conducted a retrospective study analyzing data collected during a 10 year period of referrals for frozen shoulder of both diabetic and non-diabetic patients. They hypothesized that diabetic patients with frozen shoulder who received MUA would have the same outcomes as the non-diabetic group [7]. Thirty-nine diabetic shoulders and 274 non-diabetic shoulders were assessed pre-MUA with an Oxford Shoulder Score (OSS). Of the 39 diabetic shoulders, 23 were available for long-term follow up, with 229 of the 274 non-diabetic shoulders available for long-term follow up [7]. Their study found no significant difference in the OSS between the two groups after the initial MUA [7]. OSS was 27 before first MUA and 41 after first MUA in the diabetic group, and 27 before first MUA and 43 after first MUA in the control group [7]. Conclusively, they believe that MUA offers significant subjective and objective benefit for diabetic patients with frozen shoulder [7]. These results are important for diabetic patients as they tend to have a higher risk of perioperative complications with more invasive techniques that may be used to treat frozen shoulder [7].

Wang et al. [8] conducted a study observing the outcomes of both diabetic and non-diabetic patients treated with MUA for frozen shoulder. Using an adjusted Constant score of 75 rather than the score system of 25 points usually used for assessment of muscle strength, the authors retrospectively analyzed 42 non-diabetic shoulders and 21 diabetic shoulders [8]. Their findings showed no statistical difference for pain, activity, ROM and adjusted Constant scores between the two groups [8]. Therefore, Wang et al concludes that MUA speeds up the recovery of frozen shoulders and improves shoulder function and symptoms within a relatively short period of time [8]. They believe that although diabetes is a precipitating factor for frozen shoulder, it is not correlated with a worse prognosis [8].

MANIPULATION AND OPIOID USE

Another very interesting topic that is beginning to come to light is the relationship of manipulative services and the use of prescription opioids in patients. The heavy use of prescription opioids began in the 1990s and today, there are more than 650,000 opioid prescriptions being dispensed per day [2]. Little evidence exists proving that opioids improve chronic pain, quality of life or functioning in daily activities [2]. The opioid epidemic cost nearly \$56 billion in health care and social costs in 2007 alone [2]. Therefore, other alternative options must be explored in order to address this ever-growing problem. Whedon et al. [2] conducted a study with the objective of attempting to make a connection between patients who receive chiropractic services and if that results in a lesser likelihood of refilling an opioid prescription. They retrospectively analyzed 13,384 subjects with 6,868 being recipients and 6,516 being non-recipients. Recipients included subjects with at least two office visits for a primary diagnosis of low-back pain, for which the provider was a doctor of chiropractic medicine [2]. Non-recipients included subjects who received no services from chiropractors [2]. The authors found that among the recipients, 19% refilled a prescription opioid compared with 35% of the non-recipients ($p < 0.0001$) [2]. Also, the adjusted likelihood of filling a prescription for an opioid analgesic in 2014 was 55% lower in the recipient group compared to the non-recipient group ($p < 0.0001$) [2]. These findings have the potential to have a tremendous impact on how musculoskeletal pain is approached in medicine today. However, the authors admit that this study alone is not enough proof to definitely link the manipulative technique of chiropractic services with the likelihood of refilling an opioid prescription [2]. Further studies must be carried out to further confirm the benefits that manipulation techniques may have in reducing opioid use among patients.

LIMITATIONS OF MUA STUDIES

One of the major limitations in assessing the efficacy of MUA is the unavailability of an objective way to evaluate pain improvement in patients. Additionally, not all studies use the same methods to assess pain and therefore it is

difficult to compare multiple studies in this manner. In the study on opioids, there were many factors that were unavailable to the researchers, such as fill dates for the prescription or diagnoses available in the pharmacy data [2]. Also, the conclusions drawn from this study alone are not sufficient to definitely link the use of chiropractic services to the likelihood of filling an opioid prescription [2]. Another limitation of MUA studies is that research has not been conducted to compare a group of patients who receive MUA for frozen shoulder and a group who do not receive MUA. Therefore, we cannot say for sure whether MUA truly speeds up recovery from a frozen shoulder, or if the illness would resolve on its own in the same amount of time. Studies must be carried out comparing MUA and non-MUA groups in examining their progress in range of motion over time to further legitimize the efficacy of MUA. Future studies on MUA could be improved in a number of ways. The studies mentioned in this review have a variable range of follow-up periods, some lasting as few as six weeks. We recommend a follow-up period of at least 6 months to assess the efficacy of MUA. Additionally, many of the studies did not mention how MUA affected their activities of daily living. This is an extremely important variable that needs to be further explored in order to improve patient care, as range of motion alone does not explain how MUA has affected their lives in a positive or negative way.

DISCUSSION

MUA is a procedure that requires further studies to determine whether it should be used in future clinical practice, but has proven to be useful in many different areas of orthopedic medicine. In this manuscript we attempted to gather all of the highest quality evidence available in order to investigate its efficacy. However, we realize that larger sample sizes are required in order to accurately measure whether it is superior to other methods of standard treatment. Hence, if MUA proves to be as successful for treating the listed ailments as other measures of treatment today, we may see a major change in the way orthopedics are practiced in the future. Due to MUA being a non-invasive procedure, patients may see a lesser financial burden in the future due to decreased hospital stay among other financial factors. Wang et al. [5] found that there was less improvement in Constant-Murley scores in patients with postoperative frozen shoulders. They believe this may be influenced by the initial injury or initial operation. Studies should be conducted comparing the efficacy of MUA on shoulders that have undergone surgical intervention and those that have not. Manipulation under anesthesia can provide numerous benefits for qualified patients. The literature thus far has shown its efficacy in practice and should be considered by physicians for patients who suffer from chronic musculoskeletal stiffness and pain. We believe that further studies must be carried out to examine its effectiveness compared to other techniques and practices in the medical field.

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