CASE REPORTS

MANIPULATION UNDER ANESTHESIA: A REPORT OF FOUR CASES

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ABSTRACT

Objective: To report the results of manipulation under anesthesia (MUA) for 4 patients with chronic spinal, sacroiliac, and/or pelvic and low back pain.

Methods: The treatment group was arbitrarily selected from the chiropractor's patient base who received the MUA protocol along with a follow-up in-office articular and myofascial release program that mimics the MUA procedures. The chiropractic adjustments and articular and myofascial release procedures were performed in a chiropractic office. The MUA procedures were performed in an outpatient ambulatory surgical center. Patients with chronic pain who had not adequately responded to conservative medical and/or a reasonable trial (4 months minimum) of chiropractic adjustments, and had no contraindications to anesthesia or adjustments, were selected. The 4 patients went through 3 consecutive days of MUA followed by an 8-week protocol of the same procedures plus physiotherapy in-office without anesthesia. Data included pre- and post-MUA passive ranges of motion, changes in the visual analog scale, and neurologic and orthopedic examination findings. The patients had follow-up varying from 9 to 18 months.

Results: Increases in passive ranges of motion, decreases in the visual analog scale rating, and diminishment of subsequent visit frequency were seen in each of the patients.

Conclusion: Manipulation under anesthesia was an effective approach to restoring articular and myofascial movements for these 4 patients who did not adequately respond to either medical and/or in-office conservative chiropractic adjustments and adjunctive techniques. (J Manipulative Physiol Ther 2005;28:526-533)

Key Indexing Terms: *Manipulation, Chiropractic; Anesthesia; Manipulation, Spinal; Spine; Sacroiliac Joint; Low Back Pain*

The application of chiropractic techniques, including high-velocity low-amplitude (HVLA) chiropractic adjustments, passive stretches, and specific articular and postural kinesthetic integrations,[1,2] combined with the use of general anesthesia or conscious sedation is generally referred to as manipulation under anesthesia (MUA). Manipulation under anesthesia allows chiropractic adjustments to be provided to patients who could not otherwise tolerate, or do not adequately respond to, in-office manual techniques. Anesthesia is used to relieve spinal pain and muscle spasm and to reduce protective guarding that may limit the reduction and/or removal of articular or myofascial adhesions during chiropractic adjustments.[3] Manipulation under anesthesia is a technique available to treat patients with neuromusculoskeletal dysfunction at a greater intensity than is available in the office setting. In 1976, Morey[4] stated, "Before MUA is indicated ask yourself whether the patient can respond to conservative care."

Early osteopathic case studies showed significant results, but the procedure was risky because of the time the patient was under general anesthesia.[5] In 2002, Kohlbeck and Haldeman[3] summarized the history and current clinical knowledge regarding MUA documented in 49 articles. Current medications and more refined treatment approaches have allowed physicians to provide these procedures with much greater safety. In fact, two large malpractice insurers

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1. Painful and restricting muscular guarding interferes with the performance of spinal adjustments, mobilizations, and soft tissue release techniques in the acute patient.
2. Articular and myofascial dysfunctions cannot be adequately ameliorated with a reasonable trial (two-month minimum) of in-office procedures in the chronic patient.
3. A medical evaluation is performed to establish anesthesia safety clearance and to determine whether alternative medical treatment may be complimentary with or preferable to MUA.
4. The patient' s daily activities must be substantially interrupted by pain and dysfunction as measured with a visual analogue scale and disability measurement instruments such as the Oswestry questionnaire.

Fig 1. *Indications for MUA.*

for chiropractors, National Chiropractic Mutual Insurance Company (NCMIC) and Pi Omega Delta, cover MUA practitioners without any additional premium.

Manipulation under anesthesia procedures in the clinical setting are based on the hypothesis that adhesions in the joint capsules and surrounding supportive tissues can be altered by the use of specific chiropractic adjustments and stretching techniques.[6] The increased flexibility of the supportive tissues increases the mobility of the motion segment and associated articulations.[6] Additional suspected mechanisms for the increased motion ranges seen after MUA include the resetting of the Golgi tendon apparatus resting length.

In our experience, a large number of patients exhibit mechanical dysfunctions and persistent myofascial and/or articular motion restrictions, with many unable to perform their usual tasks at work or participate in their normal home and recreational duties. It is the opinion of Francis[7] that approximately 3% to 10% of chiropractic patients may be candidates for these procedures. The purpose of this paper is to present how 4 patients with chronic spinal, sacroiliac, and/or pelvic and low back pain responded to MUA.

Methods

Indications

In addition to evaluating whether intravenous (IV) anesthetic can be delivered safely, the indications for this procedure are used as illustrated in Fig 1.[2] The MUA procedures may be medically necessary when painful and restricting muscular guarding interferes with the performance of manipulative procedures, mobilizations, and soft tissue release techniques in the patient with acute pain or when fibrosis-maintained articular and myofascial adhesions cannot be adequately released with a reasonable trial of in-office procedures in the patient with chronic pain. Manipulation under anesthesia has been used successfully in treating those patients unresponsive to acute and chronic musculoskeletal conditions for years.[8,9] Specific attention should be given to proper patient selection.[2] Morey[4] reported that approximately 3% of patients who do not adequately respond to standard manipulation would come to require these MUA procedures.

Contraindications

Contraindications to MUA procedures may include those contraindications that apply to spinal manipulation procedures for patients who are conscious.[7] In addition, the consulting medical physician must consider anesthesia risks to the patient. Contraindications include, but are not limited to, malignancy with metastasis to bone; tuberculosis of the bone or other infectious disease; recent fractures; acute arthritis; acute gout; uncontrolled diabetic neuropathy; syphilitic articular or periarticular lesions; gonorrheal spinal arthritis; excessive spinal osteoporosis; disk fragmentation; direct nerve root impingement that would contradict spinal manipulative therapy; and evidence of cord or caudal compression by tumor, ankylosis, or other space-occupying lesion. This includes severe spinal canal stenosis from any cause, which is considered to be the primary cause of the patient's symptoms and disability.[10]

General Procedures

Before the decision to perform MUA procedures, the physician and the patient discuss the options and possible outcomes. A 7-minute video presentation familiarizes the patient with the procedures, and typical patient questions are addressed before MUA procedures. This serves as additional informed consent. Risk is minimized by performing all spinal adjustments 3-dimensionally toward the center and opposite radiographically verified misalignments (instabilities). No forces are administered in the direction of instabilities present. Also, all motions are only taken to the expected normal ranges with guidance to the amount of the resistance relative to patient size, to tissue resistance, and to the unaffected side.

There are 3 distinct stages of the actual MUA procedure: (1) sedation of the patient; (2) specific chiropractic adjustments; and (3) passive stretching and traction procedures of the spine, sacroiliac, and pelvis. In the operating room are the anesthesiologist, the operating room nurse, the chiropractor in charge of the procedure (primary chiropractor), and an assistant chiropractor (secondary chiropractor). The patient is brought to the operating room and connected to the appropriate monitoring equipment and the appropriate amount of anesthesia is administered. This typically

includes the anesthesiologist's choice of propofol (Diprivan), midazolam (Versed), sufentanyl, and, occasionally, succinylcholine, through a secured IV in the dorsum of the hand. The patient reaches a deep conscious sedation in which he/she continues to breathe on his/her own and maintain normal oxygenation without the smooth muscle paralysis of full general (surgical) anesthesia patients.[5] The principle drug used, propofol, is short acting and induces sedation and amnesia for the procedure. This drug allows the patient to awaken quickly, within 5 to 10 minutes,[11] and does not require intubation and the associated risks of long-acting paralytics and respiratory depression.[7]

A predetermined set of maneuvers are specified for every MUA patient, based on the areas of complaint and the decreased ranges of motion (ROMs). Maneuvers that may impose a particular risk to a patient, such as forced flexion with combined rotation in a patient with a disk herniation, are either modified or deleted from the protocols. The MUA procedures are typically repeated over the course of 3 days.

Lateral bending stress radiographs are taken before the MUA procedures to help direct treatment specifically at the fixated or hypomobile motion segments. This provides the chiropractor with some specific objective outcome goals, namely, improving ROM, globally and intersegmentally. The lateral bending radiographs are taken again after the second day to aid in planning the last day of the procedure for two reasons. One reason is to determine what effect the first 2 days of the MUA procedure had on the fixated and hypomobile spinal levels. Secondly, this process can help identify secondary problem areas that may be revealed by alleviation of the primary problems. These comparative x-rays allow the physicians to modify the treatment approaches more specifically to the patient's needs after the first 2 days of MUA.

Lumbar/Sacroiliac Spine Procedure

The lower extremities, lumbar spine, and sacroiliac joints are passively stretched to maximum end ROMs in flexion, lateral bending, distraction, and all rotations. The focus of these multiple maneuvers is to free fibrotic adhesions surrounding the lumbar spine, hip joints, pelvis, and lower extremities. These end-range pressures are sustained for 4 to 6 seconds with slight pressure increases during that period as allowed by the patient's tissue resistance. The second physician stabilizes the patient and provides counter-resistance to all mobilization maneuvers making the use of these directed forces possible.

The patient is then placed in a side posture position typically used for spinal adjustments with the superior knee flexed and stabilized by the second physician. The lumbar curve is placed in a neutral or slightly extended position. The upper torso is stabilized by cephalic and slight posterior pressure on the chest and shoulder. The lumbar spine is taken to the end ROM removing slack from the surrounding tissues. Selected localization of known restricted segment(s) is performed. The elastic barrier of resistance is found with force delivered 3-dimensionally opposite to the direction of instability derived from the patient's radiograph. An HVLA thrust is applied and joint cavitation was achieved. The fixated sacroiliac articulation(s) is adjusted to assure optimal mobilization. The patient is then placed on the opposite side and the same procedure was repeated. The second physician provides patient stabilization on the table, assists in turning the patient into the side posture positions, and protects the IV and monitoring lines.

Thoracic Spine Procedure

The thoracic spine and the surrounding tissues are passively stretched in flexion, lateral bending, distraction, and rotation. Scapular distraction is used to release adhesions present in the paravertebral myofascial tissues. These end-range pressures are sustained for 4 to 6 seconds with slight pressure increases during that period as allowed by the patient's tissue resistance. The second physician stabilizes the patient, guards the IV and monitoring leads, and provides counter-resistance to allow the forces to be directed in a useful fashion.

With the patient lying on the table, the upper extremities were flexed at the elbows and crossed over the chest. Segmental localization of known restricted segment(s) is selected. One hand is placed over the selected thoracic segment and the other hand positioned over the crossed upper extremities. The elastic barrier of resistance is achieved and an HVLA thrust is applied in the direction opposite to the instability and cavitation is achieved, while the second physician sustains a slight caudal traction. The second physician provides assistance during the patient positioning, stabilizes the arms during this procedure, and protects the IV and monitoring lines.

Cervical Spine Procedures

The cervical spine and the surrounding soft tissues are passively stretched to maximum motion ranges in flexion, lateral bending, distraction, rotation, and oblique stretching angles. These end-range pressures are sustained for 4 to 6 seconds with slight pressure increases during that period as allowed by the patient's tissue resistance. The second physician provides counter-forces, as needed for the different procedures, and stabilizes the patient's arms to protect the IV and monitoring lines.

Axial traction was manually applied to the cervical spine while the second physician stabilizes the thorax with a slight caudal pressure. The involved cervical segment(s) is localized on one side and the elastic barrier of resistance is found. An HVLA thrust is applied opposite to the

Table 1. *Pre- and post-MUA ROM measurements*

	Patient 1		Patient 2		Patient 3		Patient 4	
	Pre-MUA	Post-MUA	Pre-MUA lumbar	Pre-MUA cervical	Pre-MUA	Post-MUA	Pre-MUA lumbar	Post-MUA lumbar
Extension	30°/30°[c]	30°/30°[c]	30°/30°[c]	30°/55°[a]	60°/60°[a]	80°/60°[c]	30°/30°[c]	40°/30°[c]
Forward flexion	6"[a,b]	4"-5"[c]	1"[a,b]	75°/75°[c]	40°/50°[a]	75°/50°[c]	12"[a,b]	0"[b]
Right lateral flexion	25°/45°[a]	Small change	50°/30°[a]	45°/40°[a]	30°/40°[a]	40°/40°[c]	15°/30°[a]	40°/30°[c]
Left lateral flexion	35°/45°[a]	Small change	35°/30°[a]	50°/40°[c]	25°/40°[a]	50°/40°[a]	30°/30°[a]	48°/30°[c]
Right rotation	20°/30°[a]	30°/30°[c]	30°/30°[c]	90°/80°[a]	60°/80°[a]	85°/80°[c]	30°/30°[c]	36°/30°[c]
Left rotation	30°/30°[c]	30°/30°[c]	30°/30°[c]	90°/80°[c]	50°/80°[a]	80°/80°[c]	20°/30°[a]	34°/30°[c]

[a] To point of reported pain.
[b] Fingertip inches from the ground.
[c] No associated pain reported.

radiographically verified vertebral misalignment and cavitation was achieved. This procedure is repeated on the other side with continued assistance from the second physician.

A more aggressive approach to the most restricted regions is used based on patient tolerance to the MUA procedure after the first day. Spinal motions, which exhibited the most significant motion restrictions, were targeted more aggressively until normal or near normal motion ranges were obtained by the second and third day of the MUA procedures. Restricted articular and myofascial restrictions that were previously resistant released better with subsequent attempts.

After the MUA procedure, the patient is transferred to the recovery area, monitored until consciousness is regained and stability is achieved, and released from the recovery area in satisfactory condition to a responsible party for home transport.

Post-MUA Follow-up Procedure

The post-MUA follow-up procedures are considered second only to good patient selection as a determinant of a good outcome from MUA. These protocols are important to promote joint stabilization, patient independence, and decreased physician dependence.[6] The 8-week, post-MUA, in-office articular and myofascial release procedures were designed to keep the decreased ROM and the intersegmental fixations from returning[11] during the healing process. The patient is seen 3 times weekly in the first month and twice weekly in the second month.

The following are components of the follow-up program: in-office spinal adjustments; replication of all traction maneuvers and stretches performed during MUA; cryotherapy; electrical stimulation; and an exercise-based functional restoration program initiated by the third week and continuing until the 8 weeks of the program are completed. This exercise program includes basic conditioning and addresses flexibility, strength, muscular balance, aerobic capacity, and proprioceptive coordination. The patients should continue the exercise conditioning program after the 8 weeks, either in-office or at a home or private gymnasium. Other forms of adjunctive therapies, including myofascial release procedures and physiotherapeutic modalities, may also be used.

Trial of In-Office Chiropractic Care

It is thought that if the patient can tolerate it, a trial of standard spinal manipulation is warranted before MUA procedures should be performed.[7] Rumney[12] suggests a trial period from 1 day to 6 weeks, whereas Francis[13] recommends 5 to 6 weeks. Kohlbeck and Haldeman[3] recommend a 4- to 8-week trial of conservative manipulative therapy before considering the more aggressive MUA approach. Francis and Beckett[7] state that a "fair" trial of standard manipulation be given before MUA if acute pain does not prevent such a trial. If the patient does not adequately respond to standard manipulation, the attending clinician must ultimately make the decision to proceed with MUA procedures. Waiting too long to satisfy an arbitrary time requirement may delay the patient's recovery and allow further soft tissue or joint adhesions to develop.[7]

Case 1

A 38-year-old female patient had low back pain at the L4-5 vertebral levels and bilateral leg dysesthesias after referral from another chiropractor after 6 months of spinal adjustments to address her chronic symptoms. Acute episodes regularly occurred. She complained of difficulty sleeping and reported much crying, fear for the future, and increased disability. She stated that she was unable to play with her children and her condition was slowly worsening. She had a prior diagnosis as a "borderline" hypertensive.

Physical examination yielded unexceptional results except that her pulse rate was 99 beats per minute. She appeared her stated height of 5 ft 10 in and her stated weight of 200 pounds. No atrophy was noted in her lower

extremities. Neurologic examination was essentially normal with all deep tendon reflexes symmetrical and within normal limits. All muscle strengths of the lower extremities were normal at +5/5. Sensation of the lower extremities was found to be intact. Orthopedic examination revealed a slightly decreased ROM in forward flexion, right and left bending, and right rotation. Local signs of continued neuromechanical dysfunctions were still present at the L3 through S1 region primarily and secondarily in the lower thoracic spine and lower extremity myofascial tissues. These signs included functional x-ray–verified joint restrictions with pain and protective guarding, bilateral thermal alterations, and paraspinal edema. The lumbar ROMs of this patient on presentation before MUA are presented in Table 1.

Positive orthopedic tests included the straight leg raise (SLR) bilaterally at 85° causing low back pain; Patrick's FABERE test on the left side causing low back and hip pain; Ely's on the left side causing low back and hip pain; Hibb's bilaterally causing low back pain; and Yeoman's test on the left side causing low back pain. Kemp's maneuver was performed without leg pain, but with a report of tightness when performed on either side. The patient was able to walk on her toes and heels without difficulty. The sacroiliac compression test and Braggard's test were performed without symptoms.

Weight-bearing plain film lateral flexion stress radiographs revealed joint restrictions from L3 through S1 on the right and left sides. A lumbar magnetic resonance imaging (MRI) scan was performed and showed minimal annular disk bulging at L3-4 that did not impinge on the spinal canal or neural foramina. However, the L4-5 disk showed desiccation and loss of height, right paracentral protrusion that effaced the ventral thecal sac, and ligamentum flavum hypertrophy. Also evident were foraminal encroachment and mild spinal stenosis at this level. At the L5-S1 disk level, the MRI showed mild degenerative facet disease and ligamentum flavum hypertrophy.

Two weeks after the MUA procedures were performed, there were improvements in ROMs. Lumbar forward flexion allowed the patient's fingertips to reach approximately 4 in of reach from the floor. Lumbar rotation increased initially by approximately 15° in both directions and stabilized at 10°, and lateral flexion showed smaller improvements. Thoracic rotation improved from an average of 55° to 80° in each direction. The length of hamstring muscles increased. The patient improved subjectively and was able to participate in activities with her children. Her need for treatment decreased from at least 2 times weekly to approximately twice monthly. These results reflect observations up to 18 months post-MUA.

Case 2

A 28-year-old auto mechanic presented with neck pain, headaches, and low back pain resulting from being hit by a car that was traveling approximately 30 mph. He was taken to an emergency department and referred for medical treatment, which included pain medication and physical therapy. Three months later, he was evaluated and was still on total temporary disability, being unable to perform the bending and lifting required for his essential job duties. He subsequently changed to chiropractic management and eventually was referred to our office. After a reasonable trial of chiropractic and an inadequate plateau being maintained, MUA was selected as an appropriate option.

Neurologic examination of the upper and lower extremities revealed a slight muscle weakness of the right hamstring muscle at +4/5. Deep tendon reflexes were all symmetrical and brisk at +2/5. Pinwheel testing of the upper and lower extremity dermatomes revealed decreased sensation of the right C7 and the right L4 dermatomes. Specific local signs of spinal injury were present at the C3, C7, and L3-5 spinal regions. These signs included paraspinal edema, spinous process tenderness, intersegmental motion restrictions, a sustained hyperemic response after deep digital palpation, and bilateral thermal asymmetries suggesting vertebral subluxations (neuromechanical dysfunctions) at these spinal regions. Weight-bearing plain film lateral bending stress radiographs were negative for fracture or other significant related pathology. Orthopedic examination revealed a slight decrease in ROM and increased pain upon several motions before MUA.

Positive orthopedic tests included the cervical compression on the left side causing neck pain and the shoulder depression test causing bilateral stiffness. Adson's test did not change the radial pulses. The SLR on the left side caused left calf and leg pain; the Patrick's FABERE test, when performed on the right side, caused right low back and hip pain. Braggard's test, when performed on the right side, caused right calf and leg pain. Kemp's maneuver caused low back and buttock pain when performed on the right side. The patient was able to walk on his toes and heels without difficulty. Ely's, sacroiliac compression, Hibb's, and Yeoman's tests were all performed without a production of symptoms.

Two weeks after the MUA procedures, the patient was nearly asymptomatic with normal ROM. He returned to his previous occupation after 1 month. Subsequently, he was treated with in-office spinal adjustments 1 to 2 times monthly for flare-ups that have not exceeded a 3 on a numeric pain scale (NPS) of maximum 10 intensity. Before the MUA procedure, his symptoms often increased to an NPS of 6 to 9. The patient reported an approximate 80% functional and symptomatic improvement from the treatment provided. These improvements were maintained up to 18 months post-MUA.

Case 3

A 34-year-old woman had cervical and thoracic pain, limited motion, and bilateral upper extremity dysesthesias

secondary to repetitive stress injuries related to her employment. She had been with her employer for 3 years and 2 months at the time of injury. Her duties required computer keyboard and mouse use for periods of time greater than 8 hours per day. The patient noticed a gradual onset of pain in her right forearm, right upper arm, and right shoulder region with pain radiating into her neck on the right side and bilaterally in her upper back. Headaches accompanied her right upper extremity and neck complaints, with symptoms rated at 5 to 7 on an NPS.

Initially upon seeking treatment, the patient had been given a "tennis elbow" brace and a shoulder sling to immobilize her right upper extremity by her medical physician; she was also provided a cortisone injection into her right wrist extensor musculature and Vicodin and ibuprofen for pain. After the medical treatment failed, she was referred for physical therapy with no appreciable response. At that point, the patient sought chiropractic care and was treated 3 times per week for 6 weeks. Treatments included specific intersegmental spinal adjustments, soft tissue mobilization, interferential current, home exercises to increase region and total body flexibility and strength, and ergonomic counseling. After a reexamination, the patient was treated at a frequency of 2 times per week for an additional 8 weeks. However, the patient did not show any significant lasting improvement. Finally, after 11 months from the initial treatment, the patient was referred for evaluation to determine her candidacy for MUA.

The cervical compression test was positive during right and left maximal cervical compression causing neck pain. The shoulder depression test was positive when performed on either side, causing increased neck pain. A modified Spurling's test was positive on the right and cervical distraction caused increased neck pain. Valsalva's and George's tests were negative. Neurologic examination revealed hypertonicity upon palpation of the right and left trapezius muscles, cervical and thoracic paraspinal musculature, right and left levator muscles, and the right and left scalene musculature. Deep tendon reflexes were symmetrical and normal. Upper extremity manual muscle testing was normal at +5/5 bilaterally. All cervical ROMs were decreased with pain provocation reported by the patient prior to the MUA procedures.

Specific signs of spinal intersegmental dysfunction (fixation) were noted at spinal levels C1-2, C5-6, and T6-7. Weight-bearing plain film lateral flexion stress radiographs were interpreted as evidence for abnormal coupling motion at the spinal levels of C1-2, C5-6, and T6-7. A cervical MRI failed to show any significant central canal or intervertebral foramen stenosis. Mild disk bulges were noted at the C5-6 and C6-7 levels.

Post-MUA, all orthopedic tests were negative, except that hypertonicity was noted upon palpation of the right trapezius muscle and pain on left lateral bending. Approximately 9 months post-MUA, at the request of the industrial carrier, the patient was referred to an independent medical examiner for reevaluation. The examiner reported subjective complaints consistent with occasional neck stiffness reported at 1 to 2 on an NPS and virtually no upper back and headache complaints. The patient's only complaint related to her right upper extremity was intermittent pain localized to the wrist extensor musculature reported at 2 to 3 on an NPS. In comparison with 80 treatments during the prior year, the patient required only 7 chiropractic treatments over 9 months post-MUA.

Case 4

A 31-year-old, 10-year veteran worker at an automobile assembly plant had lumbar pain, limited motion, and bilateral lower extremity dysesthesias specific to the posterior thighs and plantar surfaces of his feet. The patient was injured 3 years prior as a transfer unit moved a vehicle he was working on and his tool gun struck him and threw him to the floor. Immediately after the accident, the patient experienced pain in his lower back, reported at 7 on an NPS, attendant lumbar paraspinal muscle spasm, and bilateral posterior thigh numbness. His employer directed him to seek occupational medicine care, and he was treated with Vicodin, Soma, and Motrin. After 3 weeks with no improvement, the patient underwent an 8-week treatment regimen of ultrasound, electrical muscle stimulation, moist heat, and floor exercises. He failed to improve and was referred for a lumbar MRI, which noted a 5-mm disk protrusion at the L5-S1 level. It was determined at this point that the patient was not a surgical candidate and was referred for a chiropractic evaluation and treatment. The patient continued to be on temporary total disability during 65 chiropractic treatments over the course of 7 months. Although he benefited from this chiropractic treatment, the patient desired further relief and was referred to these authors for the MUA procedure.

The patient's left SLR was positive at 50° and increased lower back and left lower extremity pain. The sitting SLR on the left increased lower back pain. Braggard's test was positive on the left and negative on the right. Kemp's maneuver on the left and right produced lower back and lower extremity pain, the lower extremity pain correlating to the side of the test. Patrick's FABERE test and Valsalva's were performed without symptoms. Neurologic examination revealed hypertonicity upon palpation of the paraspinal musculature spanning from T12 to S1, the left and right tensor fascia latae muscles, and the left external hip rotator muscles. Deep tendon reflexes were symmetrical and normal. Upper extremity manual muscle testing was normal at +5/5 bilaterally. Lumbar ROMs were decreased and painful in several planes of motion.

Specific signs of spinal intersegmental dysfunction were noted at T8-9 and L5-S1. Weight-bearing plain film lateral flexion stress radiographs showed abnormal coupling

motion at spinal levels T8-9, T12-L1, and L5-S1. A lumbar MRI revealed no evidence of significant central canal or intervertebral foramen stenosis, but the presence of a 5-mm disk protrusion at the L5-S1 level.

A follow-up examination was performed 12 weeks after the patient's MUA procedures. The patient reported subjective complaints that were consistent with occasional low back discomfort reported at 2 on an NPS. He further reported complete resolution of his bilateral lower extremity complaints. All orthopedic tests were essentially negative and ROMs were normal. The patient returned to full duty with his original employer, working without restriction on the automobile assembly line. Twelve months later, the patient had received a total of 8 chiropractic treatments on an as-need basis, as compared with 65 treatments received over the 7 months before his MUA.

Discussion

The 4 cases presented in this study show an application of MUA to patients who tolerate in-office chiropractic adjustments, but failed to progress to functional and acceptable asymptomatic levels. The patients presented with a diagnosis of vertebral subluxation complex (neuromechanical dysfunction) complicated by myofascial and articular fibrosis, although the patient histories, the physical examination findings, and the spinal regions affected with each patient were different.

The authors are not suggesting that the results seen with these patients are representative or predictive of results expected on any individual case in a larger population. Results with more aggressive procedures for chronic spinal pain may be expected to offer help for a lesser percentage of patients because only the most complicated and advanced cases are undergoing these MUA procedures. However, Siehl and Bradford[8] reported that 60% of their 87 MUA patients had good or excellent results. Siehl[9] also reported 71% "good" results in the 723 cases reported in 1963.

The authors have seen very favorable responses with an estimated 10% showing no substantial improvement. Our postprocedure quality assurance telephone calls to patients performed by nurses showed that an estimated 70% were "very satisfied," consistent with the findings of others in the reported literature. The remaining 20% of favorable responses noted above were described by patients as "satisfied." No patients seen in our offices reported a worsening of their condition once their expected postprocedure symptoms subsided. We have studied these cases to assist in future improvements in patient selection. Similar to Siehl[9] and Bradford,[8] Vannetiello and Soto reported in an internal retrospective quality review (Bay Area Ambulatory Care Center) using patient questionnaires that approximately 70% of the patients treated with MUA improved substantially with clear and significant pain reduction, functional capacity increases, and disability reductions. This retrospective review also showed that approximately 30% of these 400 patients had results exceeding simple improvements, including some apparent autonomic nerve mediated and general health benefits. In one patient, a long-standing vertigo that caused frequent falls was abolished without return of symptoms on an 11-month follow-up. In another, drug medication was reduced by 75% in a patient with disabling daily headaches. In another, posttraumatic daily headaches were abolished after the second day of these procedures and did not return. Patients on total temporary disability from work for periods of 3 to 50 months returned to work successfully within a 2- to 16-week period. One patient included in these studies went from being totally temporary disabled to playing professional football in a 6-month period. Similarly, West et al[2] reported a very favorable reversal in patients out of work before MUA (68.6%) and those returning to unrestricted activities at 6 months after MUA (64.1%). In addition, perhaps most importantly, functional capacity losses were reduced, allowing patients to return to numerous recreational and family-related activities that improved their lives substantially.

Other studies support the efficacy and safety of the MUA process for properly selected patients over the past several decades. Kohlbeck and Haldeman[3] provide a literature review of MUA (49 articles) that concluded the following: medication-assisted spinal manipulation therapies have a relatively long history of clinical use and have been reported in the literature for more than 70 years. However, evidence for the effectiveness of those protocols remains largely anecdotal, based on a case series mimicking many other surgical and conservative approaches for the treatment of chronic pain syndromes of musculoskeletal origin.[3]

Considering the high cost of managing these patients, the number of patients with this type of complaint, and the resultant negative effects on these patient's lives, further studies in the area of MUA, such as randomized clinical controlled trials, are recommended.

Conclusions

The 4 patients presented in this series initially failed to show lasting improvement from a trial of typical chiropractic management and conservative medical care; however, they improved with MUA. Manipulation under anesthesia may be an effective option for patients with chronic pain who have not adequately improved with in-office chiropractic or other adjunctive approaches.

References

1. Wiesel SW, Boden SC, Feller HL. A quality-based protocol for management of musculoskeletal injuries. Clin Orthop Relat Res 1994;301:164-76.

2. West DT, Mathews RS, Miller MR, Kent GM. Effective management of spinal pain in one hundred seventy-seven patients evaluated for manipulation under anesthesia. J Manipulative Physiol Ther 1999;22:299-308.
3. Kohlbeck FJ, Haldeman S. Technical report: medication-assisted spinal manipulation. Spine J 2002;2:288-302.
4. Morey LW. Osteopathic manipulation under general anesthesia. J Am Osteopath Assoc 1976;73:61-72.
5. Gordon RC. Manipulation under anesthesia. Chiropr Prod 1998;36-8.
6. Herzog J. Use of cervical manipulation under anesthesia for management of cervical disc herniation, cervical radiculopathy, and associated cervicogenic headache syndrome. J Manipulative Physiol Ther 1999;22:166-70.
7. Francis R, Beckett RH. Spinal manipulation under anesthesia. In: Lawrence D, editor. Advances in chiropractic. St. Louis: Mosby Year Book; 1994. p. 325-40.
8. Siehl D, Bradford WG. Manipulation of the low back under general anesthesia. J Am Osteopath Assoc 1952;52:239-41.
9. Siehl D. Manipulation of the spine under general anesthesia. J Am Osteopath Assoc 1963;62:35-41.
10. Tain L, Gunderson C, Cremata E, Lerner F, Ringler L, Committee for Manipulation Under Anesthesia. Recommendations to the Industrial Medical Council Work Group of California for manipulation under anesthesia use for injured workers. Sacramento: IMC; 2003.
11. Roberts ES, Cremata EE, Collins SL. Fibrosis release procedures, including manipulation under anesthesia, a handbook defining the mobilization, myofascial release, and spinal adjustive procedures for the primary and secondary doctor of chiropractic. Fremont (Calif): Fremont Chiropractic Group; 2003.
12. Rumney IC. Manipulation of the spine and appendages under anesthesia: an evaluation. J Am Osteopath Assoc 1968; 68:235.
13. Francis R. Spinal manipulation under general anesthesia: a chiropractic approach in a hospital setting. J Chiropr 1989; 26:39-41.