Effective Management of Spinal Pain in One Hundred Seventy-seven Patients Evaluated for Manipulation Under Anesthesia

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ABSTRACT

Objective: To demonstrate that manipulation under anesthesia (MUA), a conservative treatment modality, is both safe and efficacious in the treatment of both acute and chronic spinal pain disorders in appropriately selected patients. MUA can be safely used to treat pain arising from the cranial, cervical, thoracic, and lumbar spine, as well as the sacroiliac and pelvic region.

Setting: An ambulatory surgical center.

Subjects: The treatment group consisted of 177 patients between ages 17 and 65 years. Evaluation followed a treatment algorithm created by the authors as a multidisciplinary approach to patient selection, evaluation, treatment, and timing of specialized referral, in consideration of previously published algorithms. Prior forms of treatment, both conservative and surgical in nature, had failed in these patients.

Intervention: Patients underwent three sequential manipulations under intravenous sedation, followed by 4 to 6 weeks of skilled spinal manipulation and therapeutic modalities.
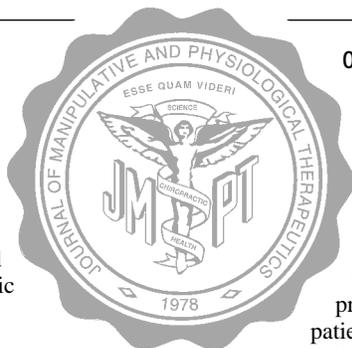
Outcome Measures: Data regarding changes in Visual Analog Scale (VAS), range of motion, medication needs, and return to work status were used to document progress. All patients had follow-up for 6 months.

Results: On average, VAS ratings improved by 62.2% in those patients with cervical pain problems. On average, VAS ratings improved by 60.1% in those patients with lumbar pain problems. There was a near-complete reversal in patients out of work before MUA (68.6%) and those returning to unrestricted activities at 6 months after MUA (64.1%). There was a 58.4% reduction in the percentage of patients requiring prescription pain medication from the pre-MUA period to 6 months after MUA. Additionally, 24.0% of the treatment group required no medication at 6 months after MUA.

Conclusion: A multidisciplinary approach to evaluation and treatment, including MUA, offers patient benefits above and beyond what can be obtained through the individual providers working alone. (J Manipulative Physiol Ther 1999;22:299-308)

Key Indexing Terms: Chiropractic Manipulation; Low Back Pain; Cervical Spine

INTRODUCTION

Ninety percent of chronic pain is localized to the musculoskeletal system. Prevalence of pain in individuals up to 59 years of age shows that the most common sites of involvement include the head and neck, shoulder, low back, and pelvis.[1-3] Eighty percent of individuals in the western world will be afflicted by some form of acute and chronic spinal pain problem. Of every 10 people under age 45 who have chronic medical conditions that limit their activities of daily living, four have back and spine pain.[4] Spine-related disorders are second only to the common cold as a reason for missed work.[4] Musculoskeletal conditions have been recognized as a major health and economic problem, imposing a $126 billion burden in 1988.[5]

Standard medical algorithmic treatment approaches to acute and chronic spinal pain problems are initiated through conservative therapy. Conservative therapy has historically consisted of a combination of short-term bed rest, physical therapeutic modalities, exercise, oral pain and antiinflammatory medication, biofeedback, and injection therapies.[6] The algorithms have been continuously updated on the basis of feedback from actual patient experiences, as well as technical and research advances.[7-10]

Recent algorithms acknowledge spinal manipulative therapy (SMT) as a viable therapeutic treatment option in appropriately selected patients.[6,11] Conservative conscious SMTs have been proven beneficial in the management and treatment of a variety of spinal pain disorders.[12-14]

Manipulation achieved the highest rating among all commonly recommended treatment options in the initial phase of care on the basis of 42 studies of physical treatment methods.[14] A 1996 study by Koes et al[15] provided a systematic review of 36 randomized clinical trials. These studies revealed that there is as much evidence in favor of manipulation for chronic low back pain as there is for acute low back pain.

Most cases of low back pain are believed to result from mechanical derangement of the soft tissue of the paravertebral spine. Resulting inflammation leads to varying degrees of pain at rest and active motion, decreased functional capacity and decreased ability to perform activities of daily living. Often, paravertebral tissue nociceptors and ascending afferent nerves become depolarized via direct pressure or

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300   Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

other derangement. This derangement alters neurosynaptic transmission along the nerve either at the axon, dorsal, or ventral nerve roots or along other interneuronal branches that penetrate soft tissues to the end nerve organ receptor.[16]

Subluxation is a term used to describe a biomechanically dysfunctional joint that has a misalignment component, an aberrant motion component, and a resistance component.[17,18] Pettibon[17] has described it in a simple equation: $S = D \times R$, where S = Subluxation, D = The distance the vertebrae is displaced from an optimal position in degrees (measured on plain film radiographs), and R = Soft tissue component or resistance necessary to overcome ligaments, tendons, or muscles to make biomechanical correction.

On initial patient evaluation, this formula permits determination of the degree of subluxation with respect to the numeric magnitude of the involved spinal segments. On subsequent radiographic evaluation, use of this formula allows for determination of a percent change in the degree of subluxation, which can now be quantified for purposes of pre-outcome and postoutcome assessment. Initial radiographic evaluation occurs in conjunction with the history and physical examination. Magnetic resonance and computed tomography imaging, as well as cineradiography (video fluoroscopy), are used as indicated for adjunctive diagnostic purposes.

The goals in treatment of mechanical spine pain is to correct the aberrant spinal motion of the involved segments, thereby improving function and decreasing pain. This is achieved via a variety of techniques, most of which can be simplified into two types of forces[19,20]: (1) high-velocity, short-duration and (2) low-velocity, long-duration.

These two applications of force will affect different aspects of the subluxation components. The former affects the osseous disrelationship or misalignment. The latter addresses the "tough soft tissue" component. These applications are used in an isolated or combined fashion, depending on the nature of the lesion. Office-based SMT is rendered via specific short-lever arm-adjustive forces typically combined with traditional physiotherapeutic modalities such as ultrasound, hydrocollator, interferential, cryotherapy, traction, and passive/active rehabilitation.

A percentage of these patients ultimately will not respond to conscious SMT on the basis of one or more of the following criteria:
1. Chronicity of the case because of joint or soft tissue fibrosis, which has inhibited restoration of appropriate joint mechanics
2. Acute myofascial rigidity and painful inhibition, which disallows conscious SMT
3. Severe joint dysfunction and subluxation such that correction of evident spinal biomechanical misalignment is not achievable through conscious SMT
4. Contained disc herniation (bulge) of less than 5 mm that has become refractory to conscious SMT
5. Multiple recurrences during the active-resistive phase of joint rehabilitation

The criteria outlined above represent the various pathophysiological environments that are therapeutically refracto-

ry to the use of these forces when applied in conscious SMT. We will discuss the means by which these same applications of force can overcome areas of refractory spinal joint subluxation through the use of intravenous sedation.

Manipulation Under Anesthesia

Manipulation under anesthesia (MUA) is the use of manual manipulation of the spine combined with the use of general anesthetic. The addition of anesthetic allows for the benefits of manipulation to be shared with those patients who cannot tolerate manual techniques because of pain response, spasm, muscle contractures, and guarding.[19] MUA uses a combination of specific short-level arm manipulations, passive stretches, and specific articular and postural kinesthetic integrations to obtain a desired outcome.[12]

The combination of manipulation and anesthesia is not new because this treatment has been part of the manual medical armamentarium for more than 60 years.[21-50] MUA has been used successfully in treating those patients unresponsive to acute and chronic musculoskeletal conditions for years.[21,51] MUA has been advocated on chronically fibrosed and hypomobile spinal segments.[19,36-39] It should be noted that MUA and SMT are not innocuous procedures. Specific attention should be given to proper patient selection. Morey[22] reported that approximately 3% of those unresponsive patients would come to require these MUA procedures.[22]

Some of the more immediate concerns of SMT and MUA are of a more technical nature. One of the greatest problems today with manipulation is the attempt by clinicians to apply these techniques without formal training. Office practitioners will read text, journals, or even attend a weekend seminar in an attempt to take an untrained clinician to the level of a skilled manipulative practitioner. Many of the reported injuries related to manipulation can be attributed to inadequate, crude, long-lever force techniques.[41] Consequently, the expected good result and minimization of complications are directly related to the highly developed skills of the practitioner. This factor should not be overlooked because of the physical and technical aspects of the procedure as it does vary from other surgical procedures.

There has been much discussion regarding the use of general anesthetic in the performance of MUA.[42,43] Issues discussed include the depth of consciousness associated with general anesthesia, the inability of the patient to give pain feedback or resist overzealous manipulation, and the intrinsic guarding mechanism of voluntary/involuntary muscle fibers, which protects the elastic barrier in the conscious patient. Examples of potential injury include the inherent risks of general anesthetic agents, deformation of the joint capsule or intervertebral disk, fracture involving the vertebral segment, neurovascular compromise, and tough soft tissue hypermobility.

To address these concerns, we make the following points:
1. Only highly skilled, graduate practitioners who have been trained in structural diagnosis and manipulative treatments should be performing these procedures.[13,18]
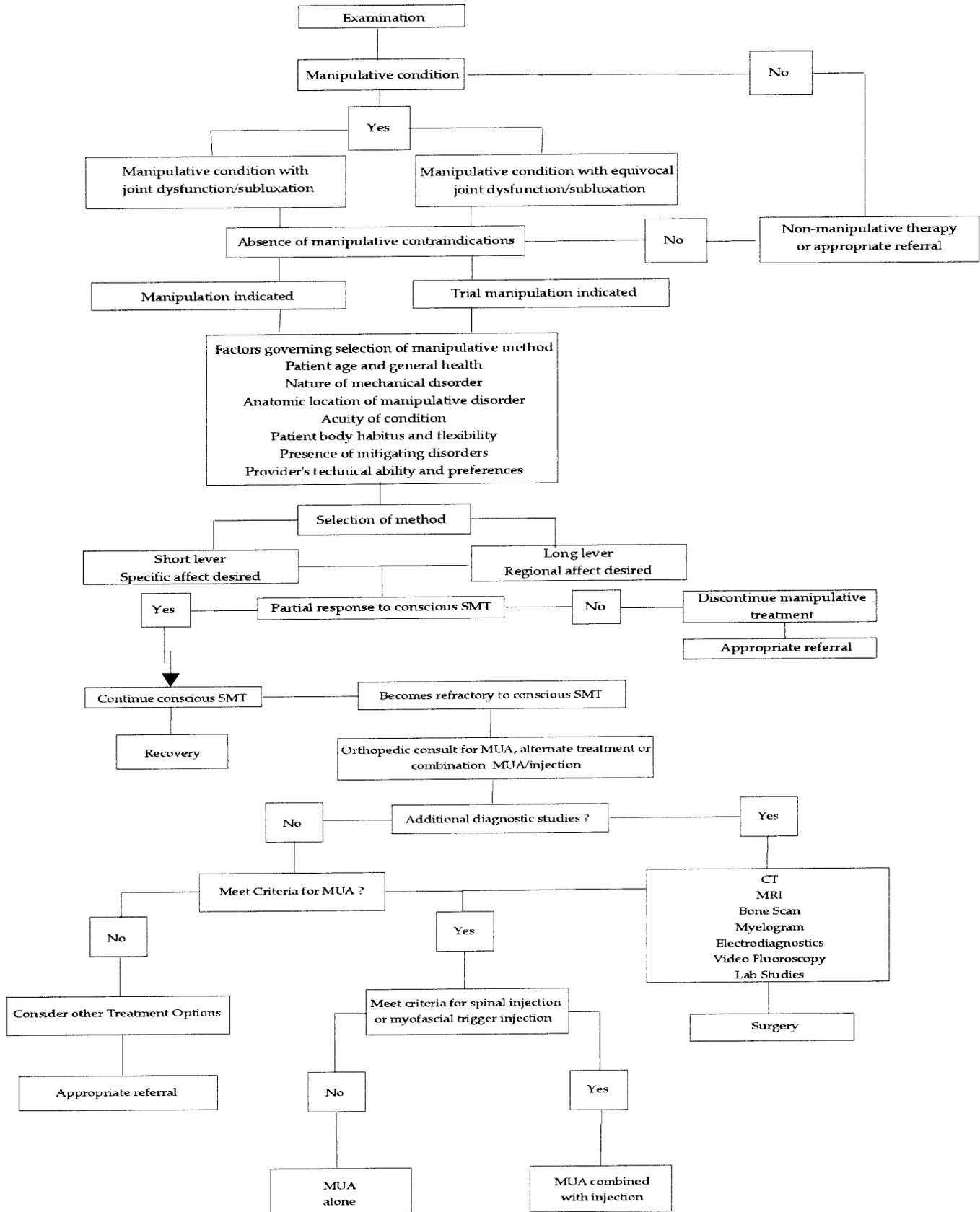
Journal of Manipulative and Physiological Therapeutics 301
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

Examination

Manipulative condition — No

Yes

Manipulative condition with joint dysfunction/subluxation

Manipulative condition with equivocal joint dysfunction/subluxation

Absence of manipulative contraindications — No — Non-manipulative therapy or appropriate referral

Manipulation indicated

Trial manipulation indicated

Factors governing selection of manipulative method
Patient age and general health
Nature of mechanical disorder
Anatomic location of manipulative disorder
Acuity of condition
Patient body habitus and flexibility
Presence of mitigating disorders
Provider's technical ability and preferences

Selection of method

Short lever
Specific affect desired

Long lever
Regional affect desired

Yes — Partial response to conscious SMT — No — Discontinue manipulative treatment

Appropriate referral

Continue conscious SMT — Becomes refractory to conscious SMT

Recovery

Orthopedic consult for MUA, alternate treatment or combination MUA/injection

No — Additional diagnostic studies ? — Yes

Meet Criteria for MUA ?

CT
MRI
Bone Scan
Myelogram
Electrodiagnostics
Video Fluoroscopy
Lab Studies

No

Yes

Consider other Treatment Options

Meet criteria for spinal injection or myofascial trigger injection

Surgery

Appropriate referral

No

Yes

MUA alone

MUA combined with injection

Fig 1. *Diagnostic/treatment algorithm.*

302   Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

ABSOLUTE	RELATIVE
Unstable Fractures	Severe Degenerative Spondylosis
Primary Bone Tumors	Severe Osteoporosis
Metastatic Bone Tumors	Progressing neurologic deficit
Spinal Cord Tumors	Inadequate physical /Spinal examination
Cauda Equina Compression	Inadequate Cerebral vascular exam
Severely Unstable Motor Units	Potential hysterical patient
Poorly developed manipulative skills	Unstable Spondylolisthesis
Large disc herniations (larger than 5mm)	Pagets Disease
Sequestered Disc Fragment	Rheumatoid Arthritis
Multiple Myeloma	Psoriatic Arthritis
Osteomyelitis	Reiters Syndrome
	Prolonged bleeding time

It should be noted that some of these conditions can still be treated providing technique is altered to non-force or passive soft tissue procedures.

Fig 2. *Contraindications to manipulative therapy.*

2. The advent of newer, short-acting, highly titratable, and completely reversible intravenous anesthetics allows for controlled anesthesia depth, preservation of patient pain response, as well as significantly reduced morbidity and mortality rates.

METHODS

A random population composed of 1936 patients sought evaluation and treatment between July 1995 and February 1997. All 1936 patients were considered for possible treatment options on the basis of the treatment algorithm (Fig 1). This algorithm was created by the authors as a multidisciplinary approach to patient selection, evaluation, treatment options, and timing of specialized referral, in consideration of previously published algorithms.[16,18,35] Of the original random patient population, 200 patients met the criteria for MUA following a defined protocol of physical and diagnostic evaluation. Each patient was evaluated by a chiropractor certified in MUA, as well as a board-certified orthopedic surgeon. Evaluations included history and physical examination, Visual Analog Scale (VAS) rating, range-of-motion testing, and plain-film radiography, as well as computed tomography or magnetic resonance imaging necessary to rule out more serious pathology that might contraindicate the use of MUA (Fig 2).[13] Subjective patient complaints involved the cervicocranial, cervical, thoracic, lumbar, and pelvic regions. These five anatomic spinal levels were grouped as cervical or lumbar for purposes of data collection and to simplify statistical analysis. Only the primary area of complaint was tracked (see procedure).

A group of 23 patients were excluded from participation in the MUA program. Instances included prolonged bleeding time,[1] severe degenerative spondylosis,[1] severely unstable motor units,[1] required spinal surgery,[4] anticipated poor compliance with requirements of protocol on the basis of history of therapy attendance,[3] and patient decision not to proceed.[13]

This left a final treatment group of 177 patients; 97 male and 80 female. Age range was 17 to 65 years, with a mean of 41.1 years.

MUA Criteria

For a patient to be a candidate for MUA, one of the following criteria must be met:[36]

1. Patients in whom manipulation of the spine or other articulations is the treatment of choice; however, the patient's pain threshold will not allow conscious SMT to be performed.

2. Patients in whom manipulation of the spine or other articulations is the treatment of choice; however, because of the extent of the injury mechanism, conservative manipulation has not been effective in 2 to 6 weeks of care, and a greater degree of movement to the affected joint(s) is needed to be effective. The sole exception to this criteria is one in which manipulation of the spine or other articulations is believed to be the treatment of choice; however, because of severe contraction of the supporting tissues or the splinting mechanism, conscious SMT is presently ineffective.

3. The patient is being considered for spinal disc surgery and the MUA procedure is viewed as an alternative or interim step, in overall consideration of the patient's condition.

4. Patients in whom manipulation of the spine or other articulations is the treatment of choice by the physician; however, because of the chronicity of the problem or the fibrous tissue adhesions present, conservative manipulation is incomplete.

Journal of Manipulative and Physiological Therapeutics 303
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

5. Patients in whom a combination of MUA and conservative spinal injection will potentiate the therapeutic benefit of either treatment alone.

It should be noted that in each of the above criteria, the patient's pain problem has affected activities of daily living.

Anesthesia for MUA

Patient selection and preparation. In selection of patients who were candidates for MUA, only patients with American Society of Anesthesiologists physical status 1 and 2 were considered.

• Physical status 1: Healthy patient
• Physical status 2: Mild systemic disease with no systemic limitation[52]

Patients known to be taking any cardiac or antihypertensive agents were instructed to take their medications on the morning of the procedure to avoid interrupting their control. Smokers were asked to refrain from smoking to reduce airway irritability. The patients were to take nothing by mouth after midnight except for their doses of essential medications. Recent electrocardiograms were requested on patients with known cardiac history.

Because all patients are sedated to the point of obtundation, airway evaluation is most critical. The safety of the patient is of the utmost concern, and the provider must have a complete understanding of the effects of general anesthesia on the unguarded or unsecured airway. With the patient in the supine position, flexion of the head causes posterior displacement of the upper airway structures that are associated with airway obstruction.[53] Extension of the head will return patency to the airway.

Anesthetic agents. Drugs typically used in MUA include midazolam (Versed) and propofol (Diprivan). Midazolam and propofol depress the central nervous system (CNS) without analgesia. This is essential to the MUA physician to avoid manipulating past the point of patient response. The concept of minimum infusion rate is defined by Prys-Roberts[53] as the defined dose of an intravenous drug that prevented 50% of a given population from moving in response to a noxious stimuli.

We use midazolam (Versed) as an adjuvant agent to provide amnesia of the procedure, as well as mild sedation. Midazolam is a very short-acting parenteral benzodiazepine given in doses of 1 to 3 mg on the basis of patient body habitus, previous anesthetics, and drug history.

Benzodiazepines work at the level of the limbic, thalamic, and hypothalamic regions of the CNS. The extent of CNS depression is dose dependent. Midazolam has twice the affinity for benzodiazepine receptors than diazepam. Benzodiazepines produce muscle relaxation by inhibition of monosynaptic and polysynaptic pathways, and they may also directly depress motor and nerve function. Bioavailability of midazolam delivered intravenously is rapid: 1 to 1.5 minutes. Midazolam is 94% to 97% protein bound and has a half-life of 1 to 5 hours.[54]

Propofol (Diprivan) is an intravenous nonbarbiturate anesthetic. It is chemically unrelated to other intravenous anesthetics. Propofol induces anesthesia as quickly as thiopental, but emergence is 10 times more rapid and is associated with minimal postoperative confusion. Unlike many other general anesthetic agents, propofol possesses an antiemetic action. For MUA this is our primary anesthetic.

Induction is carried out after the onset of the Versed given intravenously and is based on subjective response from the patient. Propofol causes loss of consciousness usually within 40 seconds, although onset may vary with dose and rate of bolus.[55]

MUA—Setup and Procedure

Before the day of the procedure, the patient is instructed regarding their nothing-by-mouth status and medications. The patient then signs an informed consent affidavit; all questions from the patient are first satisfied. The patient is then placed on the procedure table and hemodynamic monitoring is instituted, including electrocardiography, blood pressure, and pulse oximetry. Intravenous sedation is started in the arm opposite the blood pressure cuff (avoid antecubital placement of the catheter secondary to manipulative techniques and patient positioning). Supplemental oxygen is given via nasal cannula. The patient is initially sedated mildly with Midazolam and asked to provide us with input regarding the drug's activity. In our institution, propofol is the induction drug of choice, and a dose of 0.5 to 1.0 mg/kg is given with the patient monitored with regard to its effect. This provides initial obtundation, and the MUA may proceed. Careful attention is paid to the oxygenation of the patient, especially during cranial and cervical manipulation. Additional propofol is given in doses that are approximately 50% of the induction dose.

The MUA procedure generally takes between 15 and 20 minutes. The patient is continually monitored by the anesthesia provider. Blood pressures are obtained at least every 5 minutes, and a complete anesthesia record is maintained. The patient is taken to the recovery room at the termination of the procedure, provided the vital signs are stable. He or she will then be continually monitored in the recovery room, with supplemental oxygen administered on the basis of the patient's level of consciousness and oxygen saturation. Patients are discharged on the basis of the facility protocol, which includes stable vital signs, no nausea or vomiting, and return of coordinated motor function.

Procedure Note

All patients with diagnosed spinal conditions received treatment in the area of primary diagnosis, as well as the areas superior and inferior. This is due to the anatomy of the ligamentous, tendinous, and muscular origins and insertions (ie, if the lumbar spine is the primary site of injury, the treated areas were thoracic, lumbar, and pelvic).

Patients with multiple spinal regions of diagnosis were treated full spine to render appropriate care to all tissues superior and inferior to the multiple areas of joint dysfunction. In accordance with national academy guidelines, serial MUA was used. The guidelines allow for use of no less than

304   Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

two but no greater than five serial procedures. All patients underwent three serial MUAs. Performance of the MUA procedure requires a certified MUA first assistant for stabilization and patient positioning, as well as direct ancillary treatment.

All patients underwent MUA procedures consisting of a combination of passive stretching, passive ranges of motion, as well as osseous short-lever arm adjustive techniques for correction of the dysfunctional spinal articulations. All regions of the spine (cranial, cervical, thoracic, lumbar, and pelvic), as well as distal extremities, were put through all applicable planes of motion: flexion, extension, right and left lateral flexion, axial traction rotation, internal and external rotation, and adduction/abduction bilaterally. All passive ranges of motion were done firmly with stabilization by the first assistant. Stabilization was provided to all other involved spinal areas to allow as much site specificity as possible during the procedure.

Passive stretch is performed to the articular limits of passive motion approaching the elastic barrier. These techniques are modified to accommodate a variety of body types, conditions, as well as anatomic variety of body types, conditions, and anatomic variations. Many of the passive stretches are combined with distraction and are used to increase range of motion while decreasing intraarticular, extraarticular, myofascial, and interstitial adhesions. Areas of surrounding soft tissue that have muscular trigger points were treated with digital pressure techniques or myofascial release techniques at the time of passive stretch.

Subsequent to the above procedural steps, the patients underwent specific osseous adjustive techniques delivered to the dysfunctional spinal segments. Corrective forces went beyond the elastic barrier and into the paraphysiological space. Joint release and cavitation may be accompanied by an audible click, but this is not necessary to achieve the desired results. It is important to note that all forces and techniques used were adapted to prevent joint damage or instability. At no time should the corrective treatment approach the limit of the anatomic integrity of the joint.

Osseous techniques used in the pelvis and lumbar spine were generally with the patient in the side posture position. All SMT was performed to eliminate pelvic or lumbar spine rotation to avoid irritating the disc annular fibers or facet anatomy.

Osseous correction involving the thoracic spine was done via anterior thoracic technique. Particular attention must be given to anesthesia monitoring equipment, as well as placement of the intravenous tubing to avoid disruption.

Cervical spine osseous techniques are generally performed with the patient in the supine position. Direct attention must be given to avoid extension and rotation of the cervical spine. Osseous techniques used include specific short-lever arm forces addressing lateral flexion and rotational misalignment dysfunction.

In addition to the osseous manual techniques, some patients required the use of Pettibon's[16] specialized spinal biomechanical technique. For conditions involving skull subluxations in locked extension, these patients were treated with the Pettibon posterior occiput drop-piece technique. Particular attention was given to airway management, as well as to protect inherent anterior displacement of the jaw that would put the tongue and airway in compromise. Cervical spine flexion/extension joint dysfunction (hypomobility) detected on radiography and video fluoroscopy, was treated with a specific Pettibon percussion technique[16] on the offended segments. Treatment of these areas would often result in an upper extremity reflex contraction on percussion. This particular mode of treatment was used in hopes of creating enough shearing movement to the facets to restore expected normal inferior to superior and posterior to anterior glide of the articulation to restore or increase joint range of motion.

Areas of treatment were determined by clinical correlation of the physical examination in tandem with radiographic, videofluoroscopic, and imaging studies, where indicated, to confirm the areas of hypomobility, misalignment, poor segmental range of motion, and soft tissue involvement. Areas of misalignment and joint hypomobility must be considered priority areas of treatment. Areas of additional concern include loss of lordosis and dysfunctional fibrotic tissue for integrated function.

Caution should be given to the following:

1. When rendering cervical cranial passive stretch and osseous correction, specific attention must be given to avoid disturbing the sensitive temporomandibular joint articulation.
2. In treating the pelvis and distal extremities, care must be taken to support the acetabular head, neck of the femur, and femoral shaft. Care is taken to avoid long-lever arm effects in these osseous areas.
3. All patients underwent and should undergo complete George's cerebrovascular examination before treatment.

After the MUA procedure, patients were transferred to the recovery room and monitored according to postanesthesia protocol.

Post-MUA Follow-up

All patients underwent post-MUA therapy immediately after discharge from the recovery room. Post-MUA care was indicated after each day of the serial manipulative phase and monitored strictly for the next 5 to 7 days. Treatment consisted of application of cryotherapy in treated areas (10 to 12 minutes in the cervical spine, 15 to 20 minutes in the thoracic spine, and 15 to 20 minutes in the lumbar spine) combined with interferential therapy that was applied to the area of greatest symptoms (12 to 15 minutes at 80 to 150 Hz). At no time during the first 5 to 7 days after MUA was the patient permitted to be placed in the prone position, because of the indication that this position is both uncomfortable and tends to adversely affect outcome.

After completion of the passive modalities, all patients were then taken through assisted range of motion of all treated areas. This involved firm passive assistive stretch of offended joints in all planes with multiple repetition. All
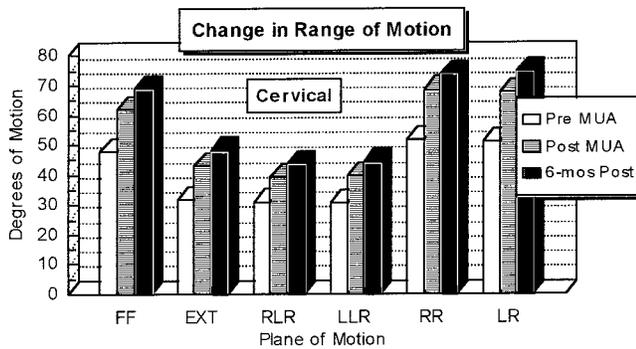
Journal of Manipulative and Physiological Therapeutics 305
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

Fig 3. *Changes in range of motion—cervical.*

Fig 4. *Changes in range of motion—lumbar.*

passive stretches were done in accordance with accepted MUA protocols. After soft tissue treatment, all patients underwent spinal manipulation of the areas of offense that were most resistant and hypomobile on radiography and fluoroscopic examination, as well as the MUA procedure. All SMT was with short-lever arm techniques, with appropriate modification because of the patient's specific condition.

This treatment protocol was maintained for the first 5 to 7 days. If there was a decrease in pain by 30% to 40%, use of ice was terminated. If pain was persistent, cryotherapy with interferential 80 to 150 Hz was maintained until a decrease in pain was achieved.

For post-MUA days 8 to 24, office visits were then decreased to 3 days per week. The patient was now able to be placed safely in a prone position for necessary modalities. Hydrocollator was used with interferential therapy at 0 to 150 Hz for 15 to 20 minutes. This was followed by traction and active range-of-motion, and exercises. Home care was to be done 2 times daily. The patient also received appropriate short-lever-arm SMT. After 2 weeks of active range of motion and assuming pain was maintained at a decreased level, the patient was entered into active resistive rehabilitation in the office 3 times per week.

At the completion of 3-times-per-week post-MUA rehabilitation or 50% reduction in pain (whichever occurs first), the patient underwent evaluation. This included range of motion, VAS, orthopedic testing, reflexes, sensory, palpatory, post-radiography, functional capacity evaluation, or strength testing as outcome assessment measures for progress. This procedure for evaluation would reoccur on completion of post-MUA therapy.

Beginning at approximately the twenty-fifth office visit after MUA, patient care involved hydrocollator with interferential therapy at 0 to 150 Hz with active resistive exercise, spinal traction, and osseous SMT. Office visits could now be reduced gradually to 2 times per week. Generally post-MUA functional capacity evaluation was done 6 weeks after MUA and used for a return to work status, as well as percent strength gain noted compared with the pre-MUA functional capacity evaluation.

For days 35 and on, office visits were reduced to a weekly basis, with passive modalities performed on an optional basis. Active resistance rehabilitation was now aggressive, with
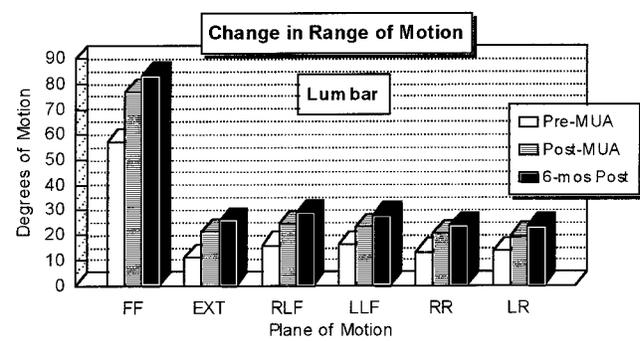
continued spinal traction and specific SMT. As reevaluation revealed full or near-full range-of-motion, with good muscle contraction, maximum medical improvement was reached. Patient care was terminated on achievement of maximum medical improvement. This was determined by plateaued range of motion, acceptable reflexes, dermatomes, and maximum improvement of evident biomechanical alterations on plain film radiographs, plateau of functional capacity evaluation, decrease in medication use, and normalization of activities of daily living.

All patients were counseled with respect to fears and expectations on return to improved lifestyle with increased range of motion and decreased pain. All patients were instructed in home care rehabilitation and flexibility programs to maintain corrections attained.

RESULTS

Outcome statistical data are presented on average for the 168 patients who completed the MUA program. Nine patients were lost to follow-up as a result of poor compliance. The associated data were not included in the statistical analysis. Outcome criteria included the degree change in range of motion taken as a whole for each treatment area; cervical and lumbar. Data regarding range of motion were obtained via goniometric measurement and compiled with respect to the six planes of movement inherent to each spinal region.

On average, cervical range of motion was found to have improved by 47.0% (Fig 3). On average, lumbar range of motion was found to have improved by 83.3% (Fig 4).

The change in the VAS was examined with respect to both cervical and lumbar complaints before MUA, after MUA, and 6 months after MUA. On average, VAS ratings improved by 62.2% in those patients with cervical pain problems (Fig 5). On average, VAS ratings improved by 60.1% in those patients with lumbar pain problems (Fig 6). There was a near-complete reversal in patients out of work before MUA (68.6%) and those returning to unrestricted activities at 6 months after MUA (64.1%) (Fig 7).

There was a 58.4% reduction in the percentage of patients requiring prescription pain medication from the pre-MUA period to 6 months after MUA. Additionally, 24.0% of the treatment group required no medication at 6 months after
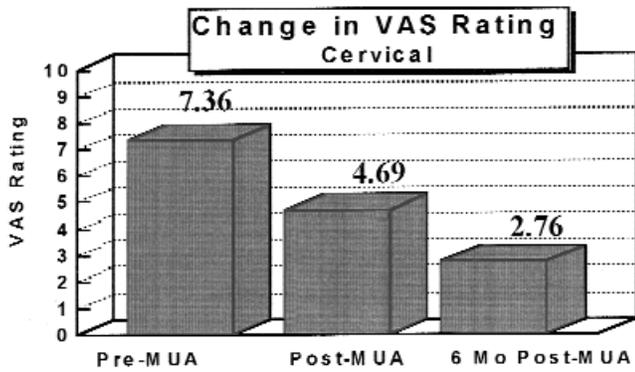
306 Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*
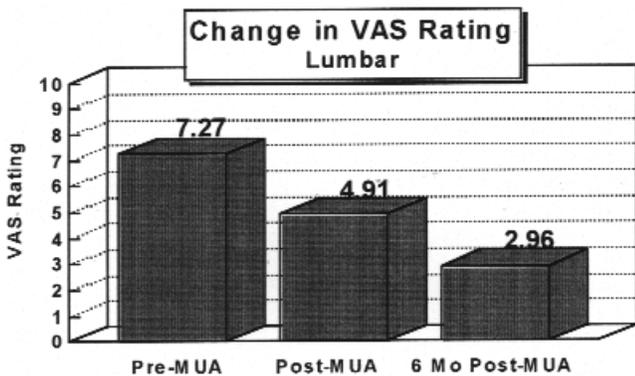
Fig 5. *Changes in VAS rating—cervical.*

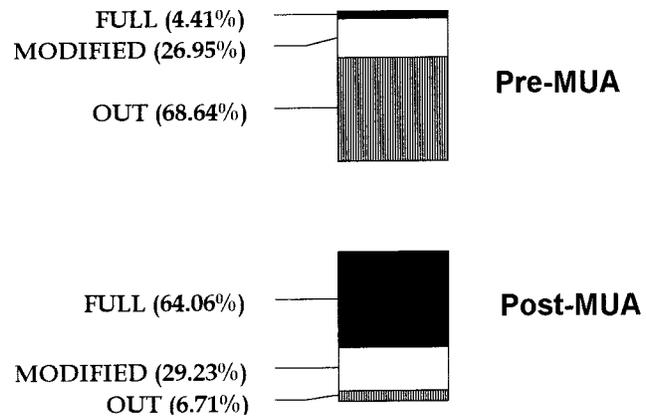Fig 6. *Changes in VAS rating—lumbar.*

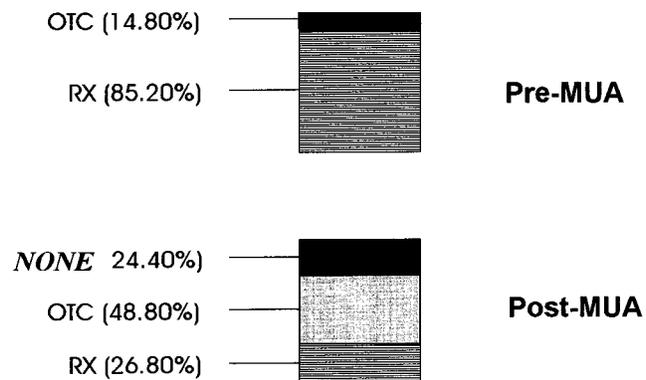Fig 7. *Level of work before versus after MUA.*

Fig 8. *Medication use before versus after MUA.*

MUA. There was a 34.0% increase in over-the-counter medication use from the pre-MUA period to 6 months after MUA (Fig 8).

DISCUSSION

In examining our results, we found it interesting to note that patient response to treatment fell into one of three broad classifications:

1. Improved range of motion and function ability, as well as a decrease in pain.
2. Improved range of motion and function ability, with a less significant decrease in pain.
3. Minimal improvement in motion, function ability, and pain.

Because we found no direct correlation between improvement in range of motion and improvement in pain, a patient-specific calculation could not be quantified in any meaningful fashion. No patient experienced a decrease in pain unless we were able to improve motion to the involved spinal segments and associated soft tissues. In no instance was a patient's condition made worse.

We observed that the best patient outcomes were achieved when the patient completed all 3 phases of the MUA program through providers certified in MUA. All patients were required to complete the serial MUA phase at our treatment facility and under the care of certified MUA physicians. Some patients were unable to complete the required follow-

up at our facility because of geography. It became necessary to arrange for follow-up with outside providers. A non-MUA–certified physician is not familiar with the multifactorial achievements of the serial MUA phase with regard to understanding their relationship to the post-MUA therapy and rehabilitation phases. As a result, we observed that these physicians were frequently unsure with regard to the proper timing by which specific post-MUA therapies and rehabilitation were added and withdrawn from the treatment plan. We observed less impressive results in these patients.

The 34.0% increase in use of over-the-counter medications (Fig 8) represents those patients who no longer required prescription medications. No patient required an increase in their level of medication at 6 months after MUA.

As we began to read previously published literature regarding MUA, several factors became evident. Dreyfuss et al[43] concluded that further study was to be encouraged and must consider a cooperative approach between health care providers. Frymoyer et al[13] states that major research is needed for optimal timing for referral of specialized services and to be cost effective, safe, and efficacious. Seihl and Bradford[56,57] state that the key to success is proper patient selection and individualized care.

We have been posed this question: With all of the treatment rendered during the MUA program, to which aspect of care do we attribute patient outcome assessment? It should

Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*
307

be evident that the patient selection process completed before the MUA program requires that the patient will not have responded fully to conscious manipulation, passive stretch, trigger point therapy, and passive modalities. The addition of intravenous sedation augments the use of manipulation and these therapies to achieve greater correction of osseous dysfunction via elimination of voluntary/involuntary inhibition. In this manner, we can increase the extent by which we can achieve plastic deformation of dysfunctional soft tissue. One must conclude that it is the addition of the anesthesia that allows the very treatment that failed before MUA to now be effective.

CONCLUSION

The primary goal of this study was to examine our positive experiences in treating a wide variety of spinal pain problems through the diagnostic and treatment program that we have described herein. We are fully aware that by not limiting our patient selection on the basis of demographics, diagnosis, and treatment of a specific area of the spine, we would sacrifice outcome specificity. We believe we have shown that this treatment program is safe and efficacious in comparison with other treatment options. Little to no duplication of services was noted because of ongoing communication between the various providers.

In completing this study, we found that a multidisciplinary approach to evaluation and treatment offers patient benefits above and beyond what can be obtained through the individual providers working alone. It is our intention to proceed with studies of a more specific design because this work has demonstrated positive results and no complications.

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308 Journal of Manipulative and Physiological Therapeutics
Volume 22 • Number 5 • June 1999
Spinal Pain and MUA • *West et al*

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