Osteopathic treatment for geriatric patients showing neuromuscular- skeletal concerns

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Introduction

Musculoskeletal disorders are common problems affecting the elderly. With age, musculoskeletal tissues show increased bone fragility, loss of cartilage resilience, reduced ligament elasticity, loss of muscular strength, and fat redistribution, decreasing the tissues' ability to carry out their normal functions. The loss of mobility and physical independence resulting from arthropathies and fractures can be particularly devastating in this population, both physically and psychologically, and in terms of increased mortality rates.

Pain specifically chronic pain often requires a diverse interdisciplinary approach for its effective management.

The Institute of Medicine report on Relieving Pain in America in 2011 declared that chronic pain is a biopsychosocial condition that often requires integrated, multimodal, and interdisciplinary treatment, all components of which should be evidence-based.

Musculoskeletal disorders are among the most common problems affecting the elderly. The resulting loss of mobility and physical independence can be particularly devastating in this population.

We will discuss the effects of osteopathic manipulated treatment (OMT) on geriatric patients presented with neuromusculoskeletal concerns.

Osteopathic manipulative treatment (OMT) is the manual treatment aspect of osteopathic manipulative medicine (OMM) and is used by osteopathic physicians to improve structure-function relationships and promote the self-regulatory and self-healing capability of patients. It is also one of many adjunctive approaches accessed by geriatric patients.

Manual osteopathy

Manual osteopathy focuses on the treatment of neuromusculoskeletal disorders through a broad range of manual techniques such as joint mobilizations, muscle energy techniques, soft tissue therapy, visceral manipulation, cranial-sacral therapy, and stretching. The effects of such techniques include; the stretching and release of muscles tendons and fascia that inhibit mobility, strengthening unstable joints, enhancing circulation and lymphatic drainage, improves nerve supply.

Manual osteopathy is a system of health care that looks at the diagnosis and treatment of the body as a whole unit. The body functions together as a whole in harmony as a result of the sum of each part. Therefore, any change within a part of the body, both internally and/or externally, will have a compounding effect on the whole. It is a type of alternative medicine and is a form of drug-free non-invasive manual medicine. Through this holistic therapy approach, there is also important for manual osteopaths to educate about diet, exercise, and lifestyle choices, to provide overall good health and wellbeing.

Philosophy of Osteopathy

Osteopathic medicine is a complete system of medicine that utilizes all available diagnoses and treatment modalities. Contrary to public opinion, it is not just osteopathic manipulative treatment (OMT) that makes osteopathic medicine different; it is the osteopathic philosophy on which the whole osteopathic system of medicine is based. At its July 2008 Annual Meeting, the American Osteopathic Association's House of Delegates approved a consensus statement on the four tenets of osteopathic medicine

- The body is a unit; a person is a unit of body, mind, and spirit. (The human body is a dynamic unit of function)
- The body is capable of self-regulation, self-healing, and health maintenance. the body possesses self-regulatory mechanisms that are healing in nature
- Structure and function are reciprocally interrelated. (Structure and function are interrelated at all levels)
- Rational treatment is based upon an understanding of the basic principles of body unity, self-regulation, and the interrelationship of structure and function. (Rational treatment is based on these principles)

  These are the four key principles of the philosophy of osteopathy.

Perhaps the most important of these is the first one that the person is composed of the human body is a dynamic unit of function. Thus, to treat the whole person, one needs to treat all three aspects. These principles are at the core of osteopathic medicine and are what make the osteopathic view of a patient distinct.

Conventional pain treatment

Conventional pain treatment consisted of treating the physiological aspects of pain (nociception, mechanical compression, neuropathy, and inflammation) and has, until quite recently, neglected the psychosocial aspects of pain.

OMM integrates osteopathic philosophy with the principles of evaluating somatic dysfunction and treating it using OMT.

History of Osteopathy

Osteopathy was founded in the United States in 1874 by Andrew Taylor Still, a frontier doctor in the Midwest. Still embraced two major elements within his new system of healing. These comprised the restoration of bodily structure and function through palpatory assessment and manipulative treatment, and a holistic view that included physical, mental, and spiritual health. The American School of Osteopathy was eventually established in Kirksville, Missouri in 1892. As schools of osteopathy evolved over the ensuing decades, they became colleges of osteopathic medicine that accepted into their curricula the scientific advances that facilitated the development of new diagnostic technologies and the improved safety and effectiveness of drug therapies. Consequently, a convergence of osteopathic and

allopathic medicine occurred in the latter half of the 20th century, with remarkable growth in the number of colleges of osteopathic medicine and osteopathic physicians that continues to this day. Nevertheless, such growth and convergence with allopathic medicine have led some to question the fundamental role of osteopathic principles and practice, particularly palpatory diagnosis and OMT, within the osteopathic profession in the 21st century.

The term osteopathy comes from the Greek words ‘osteon’ meaning ‘bone’, and ‘pathos’ meaning ‘disease’ (Parsons, et. al, 2006).

Osteopathic Principles and Practice

five models that may explain the osteopathic approach to patient care: biomechanical, respiratory-circulatory, metabolic-energy, neurological, and behavioral

Osteopathic palpatory diagnosis and OMT are used to alleviate somatic dysfunction and thereby restore normal motion and function throughout the body. In the behavioral model, a holistic approach involves physical, psychological, social, cultural, behavioral, and spiritual aspects of medical care so that a collaborative patient-physician relationship may be established. The biomechanical and behavioral models are most highly relevant to the osteopathic approach to chronic pain management when viewed within the biopsychosocial paradigm. It is worth noting that the primary aims of the osteopathic approach are to restore function and promote health-related quality of life, not necessarily to reduce pain intensity. Thus, the osteopathic approach is congruent with recent views that a primary focus on pain intensity is misguided in the management of patients with chronic pain

Most recently, it has been shown that patients treated by osteopathic physicians who use OMT for chronic low back pain report lesser pain intensity and back-related disability, while less often using opioids and nonsteroidal anti-inflammatory drugs, than patients treated by allopathic physicians.

The latter study also found that the outcomes of patients treated by osteopathic physicians who did not use OMT were comparable to those of patients treated by allopathic physicians, and were significantly worse than those of patients treated by osteopathic physicians who used OMT for chronic low back pain.

Osteopathic Manipulative Treatment and Techniques

Somatic dysfunction is defined as an impaired or altered function of related components of the body framework system: skeletal, arthrodial, and myofascial structures, and their related vascular, lymphatic, and neural elements

Somatic dysfunction is characterized by positional asymmetry, restricted range of motion, tissue texture abnormalities, or tenderness.

The latter may include pain elicited through palpation. Osteopathic manipulative treatment is used to alleviate somatic dysfunction by applying manually guided forces to improve physiologic function and support homeostasis.

OMT can be used to treat somatic dysfunction associated with a wide range of musculoskeletal conditions in older patients, such as postural dysfunction, neck, and back pain, as well as non-musculoskeletal conditions such as constipation, pneumonia, and Parkinson's disease

Research indicates that OMT is most often used to treat a restricted range of motion and least often to treat tenderness or pain.

These findings coincide with the biomechanical model of osteopathic medical practice and align with efforts to reduce pain impact rather than merely focusing on pain intensity.

Osteopathic manipulative treatment consists of more than 100 different techniques.

The OMT techniques commonly used to treat chronic pain are summarized in the table below:

Table 1

Common OMT Techniques for the Management of Chronic Pain.[17]

Technique Name	Description	Indication
High-velocity/low amplitude thrust	Rapid force of brief duration traveling a short distance, applied into a restrictive barrier.	Somatic dysfunction of an articulation.
Muscle energy	Patient's muscles are activated upon request, from a precisely controlled position, in a specific direction, and against a distinctly executed physician counterforce.	Somatic dysfunction of a myofascial structure.
Direct myofascial release	Dysfunctional myofascial tissues are loaded and a restrictive barrier is engaged with a constant force.	Somatic dysfunction of a myofascial structure.
Indirect myofascial release	Dysfunctional myofascial tissues are loaded and guided toward the position of greatest ease.	Somatic dysfunction of a myofascial structure.
Counterstrain	Specific positioning about a tender point intended to induce spontaneous release.	Presence of a tender point (small, hypersensitive point in myofascial tissue that does not have a pattern of pain radiation)
Cranial treatment	Techniques applied to the cranial bones intended to address dysfunction of the primary respiratory mechanism.	Somatic dysfunction of the primary respiratory mechanism.
Visceral manipulation	Techniques directed to the viscera or their supportive structures	Impaired mobility or motility of a visceral system and its related elements.

The use of these techniques varies according to such factors as the somatic dysfunction to be treated and the training and proficiency of the osteopathic physician. A majority of patients treated with OMT have musculoskeletal complaints, although there is extensive involvement of other body systems.

The etiologies of somatic dysfunction often interact through biomechanics and neurological reflexes. For example, positional asymmetry of an articular structure may shorten one muscle group while lengthening the antagonist muscle group, resulting in myofascial tissue texture changes. Thus, an articular somatic dysfunction may produce a secondary myofascial somatic dysfunction. In this case, patient response and physician judgment will determine whether one or more OMT techniques are needed to address the resultant physical findings and restore homeostasis.

Patient characteristics and preferences should be considered when selecting an appropriate OMT technique. Special consideration should be given to the patient's age and comorbid conditions. For example, more forceful techniques should be avoided in older patients and in those with osteoporosis to prevent the risk of injury (e.g., high-velocity, low-amplitude thrusts). Likewise, infants and young children are generally unable to adequately respond to verbal instruction, thereby including techniques) that require active patient participation. (e.g., muscle energy techniques However, patients with prior exposure to OMT may have meaningful input regarding positive or negative responses to certain treatment techniques in the past. Eliciting such information when selecting OMT techniques allows physicians to actively engage patients in their treatment plan and promotes shared decision-making.

Gentle techniques are generally preferred over more forceful techniques to minimize the risk of injury.

For instance, in a previous study of 21 nursing home residents aged 74 years and older, twice-monthly OMT resulted in significantly reduced hospitalizations and medication usage. In another study of 406 hospitalized patients aged 50 years and older with pneumonia, twice daily OMT was associated with significantly reduced length of stay and reduced hospital mortality rates. In conjunction with other manual therapies, OMT has been shown to improve psychological symptoms in geriatric patients by decreasing anxiety and anxiety-associated physical signs, such as elevated heart rate, respiratory rate, and blood pressure. Likely because of symptom improvement, OMT and similar manual therapies have been shown to improve the quality of life in elderly patients.

The trained osteopathic physician can use this palpatory information to elicit factors involved in the patient's presenting condition. Not only can one refine the source of pain generation, but it is also possible to glean additional information from the osteopathic examination—such as the presence of viscerosomatic reflexes and the acuteness or chronicity of the tissue changes. This will enable the osteopathic physician to consider

distal inputs into the patient's pain or dysfunctional areas. For example, a patient with chronic recurrent pain between the shoulder blades may have tissue texture changes (doughy, boggy, or fibrotic tissue) suggestive of a chronic viscerosomatic reflex that leads the osteopathic physician to question the patient for a history of gastroesophageal reflux disease (GERD) based on the known spinal cord level innervation to the upper gastrointestinal tract.

Upon further questioning, the patient may admit to chronic intermittent GERD, and he/she may also admit that the back pain seems to become worse with increased GERD symptoms. Without this information, a physician might continue to treat only the patient's somatic complaints, and miss the patient's intermittent, yet long-standing, GERD which is contributing to the patient's back pain. As another example, empirical data from a case-control study have demonstrated abnormal osteopathic palpatory findings at the T11-L2 spinal cord levels suggestive of a renal viscerosomatic reflex in subjects with type 2 diabetes mellitus. Moreover, the putative renal viscerosomatic reflex was greatly strengthened by the presence of co-morbid hypertension and the duration of type 2 diabetes.

Somatic Considerations in Pain

Once non-mechanical and surgical causes of pain are ruled out, a more detailed exploration of somatic (mechanical) causes of pain can be performed. When determining if somatic dysfunction is a main contributor to a patient's pain, it is important to isolate the pain generator. This can be achieved by palpation of the somatic dysfunction while paying attention to tissue texture abnormality, asymmetry, restriction of motion and tenderness (TART), and any pain referral pattern. Pain patterns are most commonly taught on a neurological level, looking at dermatomal or peripheral nerve distributions.

sclerotomal and myotomal pain patterns. commonly overlooked pain patterns that can confound the physician in locating the patient's pain generator

sclerotomal tissues (i.e., bones, joints, and ligaments) and myofascial tissues commonly refer pain to distant sites and often mimic radicular pain patterns.

Ligamentous tissue, in particular, is extensively innervated and is a common location of pain generation

The myotomal pain patterns have been extensively mapped out and characterized by Travell and Simons. These sources of pain generation are very common in patients with chronic musculoskeletal disorders and are, unfortunately, too often overlooked.

Osteopathic medicine places more emphasis on these concepts of pain generation. To osteopathic physicians, these fall into the category of somatic dysfunction and related pain. Knowing these patterns of pain and their most common sources (i.e., muscles and ligaments) can be extremely beneficial in patients having radiating pain without radiographic or neurodiagnostic evidence of radiculopathy.

Autonomic and Visceral Considerations

Spinal (or segmental) facilitation is achieved by input either from higher centers, visceral sympathetic or parasympathetic afferents, or somatic afferents (muscle spindles, Golgi tendons, nociceptors, etc.). Spinal facilitation is the state in which a pool of spinal neurons is kept in partial or sub-threshold excitation. These neurons then require less afferent input to discharge or send an impulse. Once a facilitated state is achieved, it can be sustained by normal central nervous system activity. Once the stimulus abnormally sensitizes the spinal interneurons, they can then develop prolonged facilitation. When discussing spinal facilitation, it is also important to define several physiological reflex arcs and interactions. The definitions of these reflexes, as described in the Glossary of Osteopathic Terminology, are as follows

- Viscerosomatic reflex: localized visceral stimuli producing patterns of reflex response in segmentally-related somatic structures.
- Somatovisceral reflex: localized somatic stimulation producing patterns of reflex response in segmentally-related visceral structures.
- Somatosomatic reflex: localized somatic stimuli producing patterns of reflex response in segmentally-related somatic structures.

It is this spinal facilitation that plays an important role in propagating chronic somatic dysfunction which can, in turn, lead to chronic pain. An example of a viscerosomatic reflex leading to spinal facilitation is that of cholecystitis. The visceral sympathetic afferents lead back to the T5-10 spinal cord segments. This abnormal and often chronic stimulation of the interneurons can lead to reflexive somatic changes (tightness and tenderness) in the parathoracic musculature. This chronic feedback loop can enable somatic dysfunction to develop, resulting in pain located between the patient's shoulder blades. The reverse may also occur. Thus, a chronic somatic dysfunction can cause or contribute to visceral disease through a somatovisceral reflex arc and its interrelation with spinal facilitation of the autonomic nervous system.

The Goal of Osteopathic Manual Therapy

The goal of OMT is not necessarily to remove the pain but to restore function to the dysfunctional structures and allow the body's self-healing mechanisms to resolve the pain. Perhaps unique to the osteopathic treatment of painful conditions is this emphasis on improving function rather than removing or resolving pain during treatment. It is more common for a patient to have palpably significant changes in the function and structures of the areas treated, and only have a partial reduction in pain immediately after treatment—followed by several days of continued improvement in pain post-treatment.

Broad-based Osteopathic Approach to Pain

Pain and nociception are not viewed as synonymous in osteopathic medicine. Nociception is the body's physiological response to mechanical, thermal, and chemical noxious stimuli. Pain, on the other hand, is the learned psychosocial interpretation of the noxious stimuli that can vary from one person to the next based on their cumulative experiences and genetic factors. Of course, our understanding of pain and its impact

on the body continues to evolve and expand. Studies of chronic pain, in particular, are beginning to show exactly how complex pain is, and how it is interrelated with the overall health or illness of the person. One good example involves studies showing brain tissue atrophy and altered sensory and neurochemical central nervous system functioning in patients with chronic pain. This is a prime example of the structure-function relationship, and how the psychosocial impact of disease can lead to pathophysiological changes in the body. Osteopathic medicine has long maintained that improvements in structural functioning can lead to improvements in the physiological functioning of the body. This more holistic view and understanding of the structure-function relationship is gaining support as evidenced by the developing field of psychoneuroimmunology. This field focuses on the vast interconnectedness and functioning of the body and mind through neurochemical and neuroendocrine networks within the central nervous system, immune system, and endocrine system.

Benefits of an Osteopathic Approach

The benefits of an osteopathic approach can be many-fold including fewer unnecessary imaging studies; decreased use of prescription pain medications; decreased time in physical therapy; decreased need for referrals; and a decrease indirect costs associated with pain. The osteopathic physician's emphasis on the musculoskeletal system, combined with a mind-body approach to patient care, leads to an expanded differential diagnosis that includes somatic dysfunction. This expanded understanding of the disease, combined with the osteopathic physician's knowledge of complex neuroendocrine reflex systems, can help integrate seemingly unrelated symptomatology and develop a holistic plan to achieve health in their patients. Because chronic pain patients are often very difficult to treat successfully, it would be to their advantage to have an osteopathic component in their assessment and treatment.

The clinical Though Process in Osteopathic Medicine osteopathic physicians perform comprehensive histories and physical examinations, as do their allopathic physician counterparts. Osteopathic physicians also listen to patients and probe for any underlying psychosocial or emotional factors relating to their health status and presenting complaints. Indeed, osteopathic physicians have been shown to more often discuss the social, family, and emotional impact of illness with their patients than allopathic physicians.

It is becoming clear that a patient's mental health is directly related to physical health. By no means does this suggest that osteopathic physicians are the only health care providers who assess psychosocial aspects when evaluating patients. However, it can be argued that it is this more expansive view and physician-patient interactions that make osteopathic physicians unique.

<u>The following cases demonstrate this distinct osteopathic approach.</u>

Low Back Pain. A 46-year-old female presents with chronic intermittent low back pain. She denies numbness, tingling, burning in the lower extremities, weakness, history of

any trauma, as well as any loss of bowel or bladder control. She describes her pain as “deep” and “achy” with occasional radiation bilaterally into the buttocks and posterior thighs, stopping at the knees. She has no family or personal history of arthropathies. She reports that over-the-counter non-steroidal anti-inflammatory drugs and home exercise help. She has had physical therapy and massage therapy, which also help, but the benefit seems not to last. Pain is aggravated by bending at the waist, sitting for prolonged periods, and heavy lifting. The rest of the history is non-contributory. She has had several imaging studies in the past, which showed mild degenerative changes of the L4-5 facets bilaterally, but were otherwise “normal.” On physical examination, she is neurologically intact to light touch, strength is 5/5 in both upper and lower extremities, and deep tendon reflexes are 2/4. All provocative orthopedic testing is negative. However, upon osteopathic structural examination, it is noticed that she has a slight Levo-scoliosis of the lumbar spine in addition to somatic dysfunction of the lumbar spine, sacrum, and pelvis. OMT is performed, with a subsequent marked improvement in the somatic dysfunction, both objectively and subjectively. The patient returns to the clinic in two weeks with a recurrence of her low back pain and the same somatic dysfunctions on examination. Due to the chronic nature of the condition, her slight lumbar scoliosis, and the fact that it improved only temporarily in response to successful OMT, more attention is now focused on postural considerations in this patient. Further questioning reveals that she has to have one pant leg hemmed shorter than the other and will wear out the sole of one shoe faster than the other. After performing OMT for the present somatic dysfunctions, the bony landmarks of the lower extremity are compared to evaluate for a short leg (functional or anatomic). Both the medial malleoli and patella on the left are superior, suggesting a possible left short leg. A postural study is ordered, and she is found to have sacral base unleveling of 15 mm on the left. At the next visit, a series of progressive heal lifts and a home exercise program are added to her treatment plan. After several OMT treatments and increases in the heel lift, she is now pain-free between visits.

Summary of Case.

The patient with low back pain illustrates the importance of posture on pain and the rationale for an osteopathic structural examination for postural decompensation or asymmetry. It also exemplifies the osteopathic clinical thought process that integrates seemingly unrelated symptoms and the holistic approach to treatment which is often needed in managing patients who suffer from chronic pain.

Summary and Conclusion

Osteopathic distinctiveness is described as the use of OMT. However, the osteopathic profession’s holistic approach to patient care, encompassing the integration of structure and function and its tradition of considering emotional and social aspects of health and healing, uniquely positions osteopathic physicians to manage patients with chronic pain. Indeed, as we discussed, osteopathic medicine embraced the more heuristic biopsychosocial approach to pain assessment and management well before conventional allopathic medicine did so. Additionally, osteopathic medicine’s focus on primary care provides an opportunity to integrate these holistic components of care in a potentially cost-effective manner by reducing referrals for specialty care and surgery for many pain patients before chronic problems develop.

Enhancing awareness of the osteopathic approach to patient care provides an opportunity to optimize collaboration between osteopathic physicians and other health care providers to maximize healing for patients.

Results of Previous Studies: A study has been conveyed by the Members of the American Academy of Osteopathy (AAO). A total of 197 of 629 AAO members (31.3%) responded to the survey, over 4 months, to participate in an anonymous online survey. The survey asked physicians to report the percentage of patients by age group (<65 years, 65-79 years, and ≥80 years) to whom they provided OMT, the types of musculoskeletal and system-based conditions for which OMT was used, and the specific OMT techniques used. Osteopathic manipulative treatment was frequently used to manage a variety of musculoskeletal conditions, except osteoporosis, in all patients in the 3 age groups. The system-based conditions most often managed with OMT were respiratory and neurologic. Various OMT techniques were used to treat patients in the 3 age groups; however, high-velocity, low-amplitude (HVLA) was usually avoided in patients aged 65 years or older.

Another study also shows the total number of presenting concerns was 12,020, and back concerns were the most common (6,406 [53.3%]). The total number of assessments was 18,290; most were neuromusculoskeletal (17,271 [94.5%]) and in the thoracolumbar region (7,109 [38.9%]). The mean (SD) number of somatic dysfunction assessments per encounter was 5 (1.7); the thoracic region was the most documented and treated (7,263 [15.8%]). With up to 19 technique types per encounter, the total number of OMT techniques documented across all encounters was 43,862, and muscle energy (7,203 [16.4%]) was the most documented. The use of high-velocity, low-amplitude (HVLA) declined as age increased ($p<0.001$). The overall treatment response was documented in 7,316 (79.9%) encounters, and most indicated improvement (7,290 [99.6%]).

The mission of the American Academy of Osteopathy (AAO) emphasizes “the integration of osteopathic principles, practices and manipulative treatment in patient care.” Osteopathic manipulative treatment (OMT) can be used to address serious conditions affecting older persons (≥65 years).

Conclusion: Osteopathic physicians who used OMT in their practice administered OMT for a variety of musculoskeletal and system-based conditions in patients of all ages. Various OMT techniques were used by these physicians for patients of all ages, except HVLA, which was mainly used in patients younger than 65 years.

The large number and increasing prevalence of multiple chronic conditions among older persons are of concern because many of these conditions are managed by multiple medications. Polypharmacy not only places older persons at risk for adverse drug effects and drug-disease interactions, but also increases the potential for falls, frailty, hospitalization, and rehospitalization., To address concerns about polypharmacy, recommendations for nonpharmacologic interventions have been made to address some of the medical needs of older patients. Osteopathic manipulative treatment (OMT)

has been shown to reduce medication use in patients, especially in those with low back pain and pneumonia.

The prevalence of chronic pain is estimated to be between 25% and 75% among community-dwelling older persons and between 83% and 93% among older persons living in institutional settings. Chronic pain can limit participation in daily activities, contribute to sleep disturbances, and increase the risk for depression and its sequelae (e.g., poor physical functioning, disability, social isolation, suicidal ideation). The American Geriatrics Society has stated that pharmacologic pain management methods used in conjunction with nonpharmacologic methods can relieve persistent pain among older adults. Osteopathic manipulative treatment is a nonpharmacologic way of addressing chronic pain in older persons.

The number of older persons (age ≥65 years) in the United States is projected to increase from 13% as reported in 2010 to 19.3% by 2030 and 20.2% by 2050. Patients in this age group tend to have an increase in health problems, chronic pain, and gait and balance disturbances. A prospective study of older persons without gait problems found that those who received OMT exhibited improved postural stability, whereas those in a comparison group who did not receive OMT demonstrated no improvements in gait and balance.

Results showed that geriatric patients receiving OMT were predominately presenting for neuromusculoskeletal concerns associated with back, neck, and lower extremity conditions, consistent with national epidemiological data for this population. The most common OMT techniques were also consistent with those used nationally by osteopathic medical students and practicing physicians.

Results from the study presented could be used to establish treatment guidelines for geriatric patients with muscular-skeletal pain. Given the high prevalence of musculoskeletal concerns in the geriatric population, clinicians should consider including OMM as part of the management of pain conditions in this population.

Special attention is required in this population, as an early diagnosis can avoid delay in treatment, which is associated with increased morbidity and mortality. Besides, a better understanding of musculoskeletal diseases can lead to the implementation of effective preventive measures, thus reducing public health expenditure, and improving the quality of life of the elderly.

Future longitudinal studies are needed to determine the length of time improvement persists and the overall health impact experienced by geriatric patients receiving OMT.

Results of previous studies may also identify clinical conditions to target in future outcome studies focusing on the quality of life, pain management, and fall risk reduction; the results may also suggest areas for improved training, effectiveness, and establishment of guidelines for OMM in the geriatric population.

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