

Management of Falls and Balance Disorders in the Elderly

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Falls, gait disturbances, and balance disorders are common clinical problems for the elderly, and these problems are associated with considerable morbidity. However, the literature reports relatively few effective treatment options, such as vitamin D replacement, exercise and physical therapy, and tai chi. Because of the limited number of available effective interventions, there is a need to explore other approaches, such as osteopathic manipulative treatment. The author reviews the limited body of literature relating to the use of manipulation for reducing fall events and improving gait and balance in the elderly. At this time, there are new opportunities for clinical and basic science research to investigate emerging uses of osteopathic manipulative treatment for managing falls, gait disturbances, and balance disorders.

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Falls are regarded as a geriatric syndrome, because they frequently occur and cause substantial morbidity and mortality in the elderly. Falls are the most common cause of fatal and nonfatal accidental injury for adults aged 65 years or older.¹ Within the population of community-dwelling older adults, between 30% and 40% fall at least once per year.^{2,3} It is estimated that falls resulting in a hip fracture cause a 20% to 30% mortality rate within 1 year.⁴ Among community-dwelling older adults whose falls have resulted in a hip fracture, between 25% and 75% never recover their prefracture level of function.⁴ The direct medical cost for fatal and nonfatal fall-related injuries among community-dwelling seniors in 2000 was estimated to be \$19.2 billion.⁵

In 2012, Fraix⁶ reviewed the literature relating to the role of the musculoskeletal system in fall prevention. The purpose of the present review is to examine the literature

relating to the use of manipulative therapy, especially osteopathic manipulative treatment (OMT), for the management of falls, gait disturbances, and balance disorders in the elderly. The present article reviews the limited number of case studies and clinical trials relevant to this emerging area of clinical research.

Evidence for Nonmanipulative Interventions

There are numerous underlying and contributing causes for fall events. Falls are a complex and multifaceted clinical problem with multiple predisposing factors. Extensive clinical research has identified risk factors and evaluated preventive interventions. Poor balance is one of the major risk factors for falls in the elderly. Impaired balance affects between 20% and 50% of those adults aged 65 years or older.⁷ Poor balance has been shown to cause a 3-fold increased risk of falling.^{7,8} Few interventions, however, have proven to be effective for preventing fall events. A systematic evidence-based review² of the literature found that when an individual is deficient in vitamin D, replacement reduced the risk of falls by a risk ratio of 0.83. Similarly, exercise or physical therapy² reduced the risk of falling by a risk ratio of 0.87.

Surprisingly, studies of multifactorial assessment and management strategies have not shown statistically significant reductions in fall risk.² An analysis of fall reduction interventions by Church et al⁹ showed that medication review and vitamin D replacement were the most cost-effective interventions for older adults residing in a residential care setting. For community-dwelling seniors, however, the most cost-effective prevention was tai chi.⁹ A meta-analysis¹⁰ of tai chi studies found evidence that the exercises substantially reduced falls for nonfrail elderly adults. Although the primary mechanism by which tai chi reduces falls is not fully understood, tai chi is thought to improve balance. It is reasonable to suppose that any treatment modality—like tai chi—that improves joint mobility, flexibility, and function could improve balance and thus reduce the number of falls.

Evidence for Manipulative Interventions

There is a small body of peer-reviewed literature concerning chiropractic treatment to improve gait and balance and reduce falls. Hawk et al¹¹⁻¹³ published a series of feasibility clinical trials of chiropractic therapy for improving balance and dizziness in elderly adults. These trials established the feasibility of using the Berg Balance Scale¹⁴ and Dizziness Handicap Inventory¹⁵ in this line of research. One of these feasibility trials¹³ enrolled 19 patients, who received nonstandardized chiropractic therapy twice per week for 8 weeks. The chiropractic techniques used were diversified, instrument-assisted, flexion distraction, soft-tissue therapy such as myofascial release, postisometric relaxation, and heat or cold. One study¹⁰ of tai chi's role in balance and falls prevention established the use of the Berg Balance Scale and other measures—such as single-leg stance test, timed up-and-go test, and computerized dynamic posturography—for assessing outcomes. There are also a number of established psychometric instruments to assess fear of falling in community-dwelling older adults.^{16,17} Despite the abundance of measurements, there is no standardized assessment tool for evaluating balance.

Cavalieri et al¹⁸ were the first researchers to conduct a clinical trial evaluating the impact of OMT on fall prevention in elderly adults. All participants were older than 65 years and had had at least 2 falls in the previous 9 months. Twenty-eight participants were randomly assigned to a standard care group or a standard care plus OMT group. Every 6 weeks for up to 6 months, group participants received a standard interdisciplinary assessment of falls, with the treatment group receiving OMT during each session. In the end, no between-group differences were observed for fall frequency, depression, pain, fear of falling, gait scores, or confidence in balance. The study suggested that if OMT is to have any application for preventing falls in an elderly high-risk population, patients will need to be treated more than once every 6 weeks. The Cavalieri study¹⁸ was limited by the small

sample size and by having been published only in abstract form.

Parkinson disease is a common neurodegenerative disorder in elderly adults characterized by a resting tremor, bradykinesia, and muscle rigidity.¹⁹ The gait and balance disturbances associated with Parkinson disease commonly contribute to falls. Between 1904 and 1909, Ashmore²⁰⁻²³ collected and edited 1200 case reports intended to document the types of health problems OMT could alleviate. Four of these case reports concern how osteopathic medicine dealt with the presentation, treatment, and outcomes of paralysis agitans (as Parkinson disease was then named).²⁰⁻²³ These reports document that early osteopathic physicians did occasionally treat patients with Parkinson disease using OMT. The treatment frequencies were usually 3 and then 2 times per week, and treatments were given for months at a time to achieve slight to modest improvements in gait and joint range of motion. For the beneficial effects to be maintained, in most cases the authors believed indefinite treatment would be needed to maintain the results. Given that Parkinson disease is a progressive neurodegenerative disease, the reported modest improvement in function without medications was an important outcome.

In the chiropractic literature, a well-described study by Elster²⁴ reported the case of an individual with Parkinson disease who received cervical manipulation. The patient was placed on a regimen similar to that of the older osteopathic case studies: initially 3 times per week for the first 2 weeks, then twice per week for 2 weeks, then once per week. During a period of 3 months, the patient reported subjective improved cervical range of motion, improved sleep, better energy, and decreased body stiffness. For a more objective measure, the author measured the patient's symptom severity at baseline and at week 12 using Unified Parkinson's Disease Rating Scale and found a 43% reduction in severity of Parkinson disease symptoms.²⁴ Unfortunately, there are few, if any, other case reports in the literature.

In 1999, Wells et al²⁵ published a randomized con-

trolled clinical trial investigating the effect of a standardized OMT protocol that focused on improving joint range of motion from the cervical spine to the ankle in patients with Parkinson disease. A single OMT session was found to have an immediate beneficial effect on gait measures. The OMT protocol statistically significantly improved stride length, upper limb velocity in the shoulder, and lower hip velocity relative to the 2 control groups.²⁵ Of interest, OMT was performed by osteopathic medical students trained in the study protocol, which suggests a high level of skill is not required to achieve measurable results.

The use of neuromuscular therapy (a form of massage therapy) for 32 persons with Parkinson disease was explored in a randomized controlled clinical trial by Svircev et al²⁶ and published as an abstract. Participants were randomly assigned to receive twice-weekly treatments for 4 weeks of either neuromuscular therapy or muscle relaxation therapy. At the end of the intervention period, the neuromuscular therapy group had improved Clinical Global Impression scores and Unified Parkinson's Disease Rating Scale Part C scores, but the muscle relaxation (ie, control) group did not improve. However, the Clinical Global Impression score improvements were not maintained 1 week after the final treatment.

A retrospective study¹⁹ of cranial strain patterns compared 30 patients with Parkinson disease with 20 age-matched controls. This study showed that cranial strain patterns are different in patients with Parkinson disease relative to the normal controls and that cranial treatment can change these strain patterns to be more like those found in controls. A letter to the editor²⁷ and subsequent reply²⁸ debated the clinical significance of these observations for the management of degenerative neurologic disorders such as Parkinson disease.²⁷

Overall, the evidence in the literature for using manipulation to manage Parkinson disease consists of a few case observations and a few small clinical trials, which is far from a conclusive, evidence-based foundation. Clearly, more clinical research is needed to estab-

lish the value of using manipulation to treat patients with Parkinson disease.

Gilliss et al²⁹ reported the case of a 65-year-old man with gait dysfunction and multiple sclerosis. The patient had a compensated Trendelenburg gait, also known as a compensated gluteus medius gait. During 2 appointments 1 month apart, biomechanical examinations revealed that he had right-on-right sacral torsion and posterior rotation of the left innominate. Gilliss et al²⁹ provided a detailed description of normal innominate and sacral motion during gait. Muscle energy techniques were used to correct this somatic dysfunction. Detailed gait analysis was recorded by means of a 12-foot mat and videotaping before and after the treatment session. All posttreatment gait mat measurements showed dramatic improvements, including a 58% decrease in the number of steps taken in 12 feet, improved step and stride length, increased velocity, and restored stride-length symmetry. The authors discussed the biomechanics of how dysfunction in the sacroiliac joint could have played a role in the patient's longer left stride and gait dysfunction. The case report suggests that a Trendelenburg gait pattern, classically thought to be due to a weakness in the proximal hip abductor muscles, may also arise from somatic dysfunction and thus may be corrected by means of OMT.

Poor balance from a wide range of other disorders—such as neuropathies, poor vision, and vestibular dysfunction—also contribute to falls and injury in the elderly. In 2011, a small study by Lopez et al³⁰ evaluated the effects of OMT on balance in healthy elderly adults. Twenty consecutive healthy elderly adults were assigned to an OMT group, and 20 consecutive healthy elderly adults were assigned to a no-OMT group. The OMT protocol included 7 specific techniques with an emphasis on improving vestibular function and several cranial techniques. The primary areas treated were the head, neck, shoulders, and thoracic spine. Participants in the OMT group received a 25- to 30-minute treatment session once per week for 4 weeks. To ensure consistency, the same practitioner performed all OMT techniques.

The researchers used a force platform, a posturographic instrument, to measure anteroposterior and mediolateral sway of participants, who were measured with eyes open, eyes closed, and with eyes closed while extending both arms. Anteroposterior sway was reduced to a statistically significant level for the OMT group at the end of 4 weeks. Nevertheless, the clinical efficacy of using OMT in individuals who already have poor balance still needs to be evaluated.

A pilot study by Fraix³¹ explored the efficacy of using OMT for chronic vertigo. This clinical trial recruited individuals aged 18 years or older who had a diagnosis of peripheral vertigo for at least 3 months. The mean age was 64.5 years. Participants with neuropathy and central nervous system pathology were excluded. The study used a simple nonrandomized baseline vs post-treatment analysis of Dizziness Handicap Inventory to assess outcomes. Participants received 4 OMT sessions using a nonstandardized protocol, which permitted using muscle energy, counterstrain, myofascial release, and balanced ligamentous tension techniques to address any somatic dysfunction found on structural examination. The results showed statistically significant improvement in Dizziness Handicap Inventory score relative to the baseline measures. Of the 16 patients who completed the study, 3 reported transient worsening of vertigo and 5 reported mild transient posttreatment muscle soreness. Only 1 participant dropped out of the study because of exacerbation of vertigo.³¹

Challenges Facing OMT-Related Studies of Falls, Gait Disturbances, and Balance Disorders

There are a number of limitations and difficulties in researching OMT for falls, gait disturbances, and balance disorders. One obvious limitation (but also an opportunity) is the limited number of projects that have explored this topic. There is a definite need for more case reports, observational studies, and exploratory pilot studies, because these are the types of projects that create the foundation for more definitive work. Students, residents, and even practicing physicians who have started OMT-related research need to be encouraged to write about their findings and then submit their articles to peer-reviewed publications. Two of the studies^{18,26} cited in this review, while reporting important results regarding manipulative therapy, are nonetheless of limited scientific value because they have been published only as abstracts.

Another difficulty facing OMT research is that the duration of treatment effect is poorly understood. The case report by Gilliss et al²⁹ illustrates this problem. The pretreatment vs posttreatment measurements showed dramatic objective improvement in gait. The 2 appointments were 1 month apart with weekly OMT sessions between the 2 study appointments. However, the baseline pretreatment measures at the start of both appointments appear to be very similar, implying the duration of effect was less than 1 week and with no lasting change after 3 or 4 weekly treatment sessions. Knowing the duration of effect and how many treatments are needed to achieve an effect are critical for study design and for the determination of clinical utility.

Establishing inter- and intraexaminer diagnostic reliability is another major challenge facing OMT research, for which a number of clinical investigators have made important contributions.³²⁻³⁶ Traditionally, OMT is a very individualistic intervention, a practice that seems hard to reconcile with the standardization required by most clinical trials. One solution is to design a treatment protocol that contains both individualized and standardized components and that provides a detailed description of the study intervention.³⁷

Determining the best control strategy is another challenge for OMT-related research—one which clinical trials involving, for instance, vitamin D replacements do not have to contend with. Clinical trials of OMT have shown that at least partial group blinding can be achieved using a sham protocol.^{38,39} A sham protocol can show partial efficacy. Furthermore, when the outcomes for the sham intervention occur in between a nonmanipulation control group and an OMT group, then the results are difficult to interpret.^{40,41}

Conclusion

Falls, gait disturbances, and balance disorders remain common problems for the elderly, all of which carry substantial public health implications. Few interventions, however, have been shown to reduce falls and injuries. Vitamin D replacement appears to be the most cost-effective intervention. Exercise and physical therapy have a modest benefit, with tai chi appearing to be most helpful for nonfrail elderly adults. The potential of using manipulation to prevent falls and improve gait and balance has not been adequately explored. The osteopathic medical profession can do much to cultivate this emerging area of clinical research by funding pilot and small research projects. Small basic science projects that explore plausible mechanisms and clinical trials that establish promising data are critical if this area of investigation is to mature. Given the high cost and morbidity associated with falls, gait disturbances, and balance disorders in the elderly, it seems reasonable that a treatment modality designed to improve musculoskeletal function is worth further investigation. This small but developing line of research relating to the potential benefits of OMT for managing falls, gait disturbances, and balance problems shows promise. This is an encouraging development, because a critical mass will be needed to determine if manipulative therapy can substantially reduce the occurrence of falls, gait disturbances, and balance problems for the elderly.

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