Effects of Osteopathic Manipulative Treatment on Pulmonary Function in a Parkinson's Disease Patient

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CASE REPORT

Abstract

Parkinson's disease (PD) is a neurodegenerative disorder with motor symptoms including resting tremor, bradykinesia, cogwheel rigidity, and postural instability. Parkinson's patients can also exhibit respiratory symptoms. The muscle rigidity associated with PD has been found to be highly correlated with the severity of pulmonary dysfunction. This case details the treatment of a 73-year-old PD patient who presented with acute dyspnea that resolved with application of osteopathic manipulative treatment (OMT). Treatment focused on addressing thoracic cage musculoskeletal restrictions, balancing autonomic flow, and improving circulatory and lymphatic flow. The patient's respiratory symptoms were alleviated despite a lack of significant pulmonary function test changes immediately post-treatment. This case demonstrates the positive effect of integrating OMT for the treatment of pulmonary symptoms in PD.

Introduction

Parkinson's disease (PD) affects over 7.5 million people worldwide with age being the most consistent risk factor.[1] The classical symptoms of this degenerative disorder include resting tremor, bradykinesia, cogwheel rigidity, and postural instability.[2] However, Parkinson's patients also exhibit respiratory abnormalities. While respiratory symptoms are not typically reported until later in the disease course, changes in pulmonary function may be observed as early as initial diagnosis.[3] The rigidity associated with Parkinson's has been found to be highly correlated with the severity of pulmonary dysfunction.[4] Chest wall rigidity may lead to low chest wall compliance resulting in a restrictive type of pulmonary dysfunction.[5] PD patients have been shown to exhibit a significant reduction in chest movement.[6] Pulmonary functions have been found to decline as the disease progresses with the majority of patients reporting respiratory symptoms at later stages of the disease.[2] The following demonstrates the application of Osteopathic Manipulative Treatment (OMT) in a PD patient who presented with dyspnea and abnormal pulmonary function.

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History

A 73-year-old female with a past medical history of Parkinson's disease (PD) diagnosed 10 years ago presented to the office with a 2-day history of progressive difficulty breathing. She reports having the sensation of difficulty breathing in the past and had prior work up by a pulmonologist and a cardiologist, which did not reveal any underlying cause for her shortness of breath. She states that she feels it more with movement and with exertion. She denied experiencing any chest pains, palpitations, leg swelling, difficulty sleeping, recent illness, cough, fevers, chills, or sputum production. She also complained of associated increased tightness of her muscles in her neck and back. She has a history of adolescent scoliosis which has been getting progressively worse the past 10 years. Her Cobb angle had increased from 25 degrees to 30 degrees. Her orthopedist has been following her scoliosis progression and

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did recommend bracing, but she did not tolerate the brace and has not been wearing it. She reported that her back-muscle stiffness and scoliosis feels worse when her PD medications wear off and more towards the end of the day when she is more fatigued. She attends yoga class twice a week to try to stretch and improve her symptoms. She denies taking any pain medications to try to alleviate her discomfort and pain.

The patient was previously diagnosed in 2007 with Parkinson's Disease in addition to having scoliosis since adolescence, osteoporosis without prior spinal fracture, and Lyme disease in 2000 treated with doxycycline. She takes Sinemet 10 mg-100 mg tablet 1 tab(s) orally 4 times a day for PD, Seroquel 25 mg tablet 2 tab(s) orally, Prolia 60 mg/mL solution subcutaneously every 6 months, Sertraline 50 mg tablet 3 tab(s) orally once a day, and Clonazepam 0.5 mg tablet, orally at bedtime as needed. She denies any drug allergies. She had a tonsillectomy when she was 20 years old. Family history was significant for her father passing at 75 years-old from heart failure, and her mother passing at 84 years-old from a stroke. She has two sons, one who was recently diagnosed with chronic fatigue syndrome. She is widowed, lives with her son, and has a pet dog in an apartment. She is a retired real estate agent. She denies any tobacco use, alcohol use, or illicit drugs. She reports drinking 1 cup of tea per day. The patient denied any fever, chills, weight loss, chest pain, nausea, or vomiting. She did complain about chronic neck and back pain and muscle stiffness. She reported shortness of breath but denied any cough. She reported having tremors and excessive movement of her torso and all four extremities worse on her left side.

Physical Examination

Upon examination, the patient was awake, alert, and oriented to person, place, and time. She did not demonstrate any labored breathing. Her temperature was 98.6, blood pressure was 115/76 mm Hg, heart rate was 90 beats per minutes, oxygen saturation was 97% on room air.

She was able to ambulate without an assist device and without any shuffling of her gait. Her head was normocephalic, atraumatic but she did exhibit masked facies. Her neck demonstrated no jugular venous distension, no bruits, no palpable masses. There was a noticeable decreased in cervical ROM rotating to the right. Heart sounds were normal without murmurs. Lungs were clear to auscultation bilaterally with no wheezes or crackles noted and good respiratory effort. Her extremities demonstrated no clubbing or edema and pulses were present bilaterally. Her leg length equal on exam.

Her neurological exam showed full motor strength to resisted motion testing, a normal sensory and reflex tested bilaterally in her upper and lower extremities. She had a tremor of her upper extremities, worse on the left side, and intermittent dyskinesia of the upper and lower extremities and trunk. She demonstrated stiffness of her joints with movement and needed assistance transferring from a supine to sitting position. She had a negative Romberg's and Babinski's sign, and straight leg test. She was positive for cogwheel rigidity in her bilateral wrists. She had a thoracolumbar scoliosis, convex left in the thoracic region and convex right in the lumbar region with associated increased paravertebral muscle spasms and tenderness.

Her osteopathic structural examination demonstrated a left temporal bone externally rotated and a left temporomandibular joint (TMJ) compression. Her neck had anterior cervical fascia restrictions, an occipitoatlantal flexed, side bent right, rotated left and bilateral scalene and sternocleidomastoid muscle spasms, her shoulders had bilateral adduction and internal rotation dysfunctions. She had muscle spasms of her bilateral levator scapulae, trapezius and pectoralis major muscles. Her thoracic cage demonstrated ribs 1-3 inhalation dysfunction bilaterally; T2—T12 neutral, side bent right, rotated left. Her lumbar from L1-5 was neutral, side bent left, rotated right. She had anterior abdominal diaphragm restrictions. Her pelvis demonstrated a bilateral sacral flexion, a right sacroiliac compression, right anterior innominate dysfunction. She had bilateral psoas muscle and thoracic and lumbar paravertebral muscle spasm. No significant Type II dysfunctions were noted in the thoracic or lumbar regions.

Assessment

The patient had PD with dyspnea and significant somatic dysfunctions of the cranium, cervical, thoracic, ribs, lumbar, sacral and pelvic regions.

Course of Treatment

Due to the shortness of breath, the patient had a pulmonary function test (PFT) performed with results listed in Figure 1. Osteopathic manipulative treatment was applied to treat somatic dysfunctions diagnosed during examination. Occipito-atlantal decompression, balance membranous tension, Galbreath's technique, and suboccipital release were applied to the cranium. Myofascial release technique (MFR), facilitated positional release (FPR), and muscle energy technique (MET) were applied to the spine and muscles. Still's technique and thoracic inlet release were

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applied to treat the inhaled rib dysfunctions and shoulder restrictions. Rib raising and doming of the diaphragm were applied to facilitate abdominal diaphragm excursion. Balanced ligamentous tension (BLT) was applied to the spinal junctions and the sacroiliac regions. Sacral and pelvic dysfunctions were treated with FPR, MET and BLT. Post-OMT pulmonary function tests were repeated. Results for the post-OMT are listed under "post-bronchodilator" in Figure 1 as OMT was performed instead of a bronchodilator treatment.

Measurement	Units	Predicted	Pre-Bronchodilator		Post-Bronchodilator		% Change
			Actual	% Pred.	Actual	% Pred.	
FVC	L	2.94	**2.22**	**76 %**	**2.08**	**71 %**	-6 %
FEV1	L	2.21	1.77	80 %	1.61	73 %	-9 %
FEV1/FVC	%	75 %	80 %	106%	77 %	103%	-3 %
FEF25%	L/S	5.14	4.68	91 %	5.36	104%	15 %
FEF50%	L/S	2.68	2.63	98 %	1.88	70 %	-29 %
FEF75%	L/S	0.63	0.54	85 %	0.45	71 %	-17 %
FEF25-75%	L/S	1.87	1.71	91 %	1.38	74 %	-19 %
PEF	L/S	5.53	4.54	82 %	4.89	88 %	8 %
Exp. Time	Sec.		6.72		6.37		-5 %
V ext.	L		0.06		0.04		-33 %

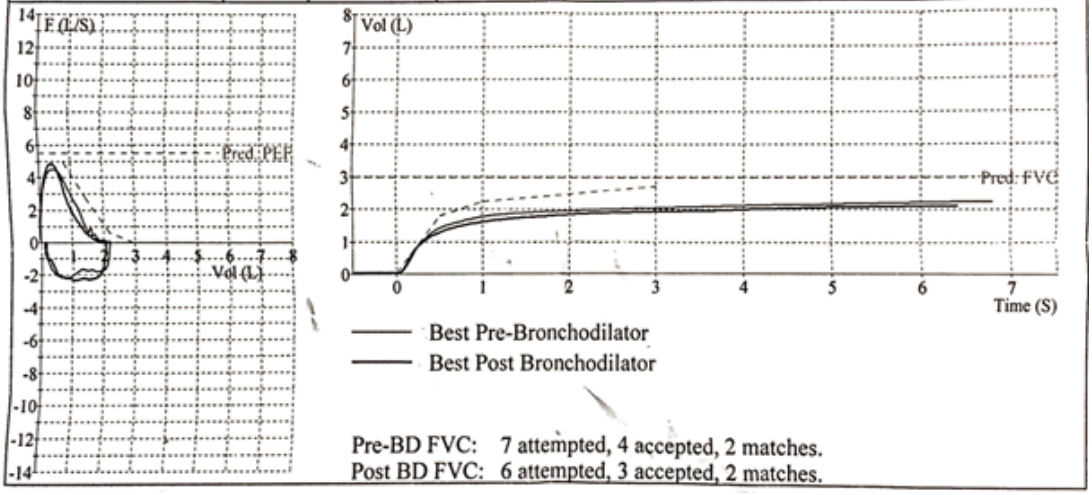

Figure 1. Pulmonary Function test results. Pre-Bronchodilator = Pre-OMT, Post-Bronchodilator indicates Post-OMT with no bronchodilator administered.

Response to Treatment

After treating the significant somatic dysfunctions with OMM, the patient reported improved breathing and resolution of neck and back pain. PFT post-OMT did not show significant change with results shown below. Her FEF25% AND PEF parameters increased, while the other parameters decreased. During the follow-up visit two weeks later, she reported no subsequent episodes of shortness of breath or pain and stated that she was able to walk around New York City for an entire day with no difficulty.

Discussion

This case demonstrates the potential effect that OMT can have on PD subjects with respiratory symptoms. It also raises the awareness of potential respiratory issue associated with the disease process in PD. In a past study featuring 35 patients with mild PD and no reported pulmonary symptoms, all were found to have a significant decrease in pulmonary functions.[5] Pulmonary dysfunction in PD has been attributed to a number of causes including "impairment of ventilatory muscle function, upper airway obstruction, abnormal control of ventilation, and pulmonary sequelae attributed to the drugs used to treat the disorder."[7] Past research has collectively established that forced vital capacity (FVC), maximum voluntary ventilation (MVV), maximum expiratory pressure (MEP), and maximum inspiratory pressure (MIP) are all significantly reduced in PD patients compared to healthy controls.[4,5,7] Pulmonary complications are some of the leading causes of death in PD patients because silent aspiration and atelectasis predisposes them to pneumonia.[8]

Osteopathic manipulative treatment (OMT) provides an option to address neuromusculoskeletal structures in order to help improve body mechanics, normalize nervous impulses, and restore the body's inherent ability to heal itself.[9] In this case of dyspnea and PD, there are multiple approaches that help to explain our patient's improvement in breathing post OMT. Excessive muscular tension of the thorax and abdomen along with autonomic dysfunction in PD are often the source of musculoskeletal dysfunction. This leads to imbalances in the muscular-fascial-ligamentous system and altered body posture.[10] Applying OMT to address somatic dysfunction of the spine and thoracic cage can improve thoracic cage excursion and compliance and decrease the work of breathing.[9] Prior studies on non-PD subjects have demonstrated positive results of OMT applied to the thoracic cage in improving lung function and reducing inflammation.[11,12] Positive results have also been demonstrated with use of lymphatic techniques in the animal model and human patients with pneumonia.[13,14] OMT has been shown to be a safe and efficacious for improved gait, motor

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function and balance in PD.[15,16] However, there have not been studies published examining the efficacy of OMT on pulmonary function in PD.

In this case, treatment of the suboccipital region and rib cage with OMT was performed to help address any autonomic dysfunctions. While the pathophysiology underlying respiratory dysfunction in PD is complicated, it is believed that autonomic mechanisms may play an important role.[17,18] The dorsal medullary respiratory center receives afferent input from carotid and aortic chemoreceptors, which may respond to either decreased arterial oxygen tension or increased arterial carbon dioxide. Patients with mild to moderate PD are reported to have reduced ventilatory responses to hypoxia and hypercapnia unrelated to muscle weakness, impaired pulmonary function, or use of dopaminergic therapy.[17]

Lymphatic treatment addressing thoracic inlet restrictions, abdominal diaphragm restrictions, and spinal and pectoralis spasms could also potentially decrease musculoskeletal restrictions that can impair pulmonary function. Severe spinal curvatures in scoliosis can also impact pulmonary function.[19] Although our patient had minimal signs of camptocormia, a distinctive and pronounced flexed posture of the thoracic or lumbar spine, it has been associated with severe PD dysautonomic and motor symptoms as well as pain.[20]

Although the patient reported immediate improvement of breathing and being able to "take a deeper breath" post OMT, no significant differences were detected pre-and post-OMM on pulmonary function tests. This could be due to patient limitations, such as fatigue, anxiety, and PD medication "wearing off" or measurement limitations.[7] Another study investigating PFT changes in cystic fibrosis subjects also failed to yield significant changes post OMM. Of note, the subjects in the OMM arm of the previously cited study did show improvement of symptoms based on survey results.[21] Our patient also had confounding factors as she had a significant 'S' scoliotic curve that may have limited PFT changes.

Overall, it is challenging to find measures that can capture objective changes in our patients at times that correlate with patient's clinical improvement. Future osteopathic research studies need to be well designed to determine the efficacy of OMT in treating respiratory dysfunction in PD, and to validate the use of PFTs in similar respiratory cases.

References

1. Ross GW, Abbott RD. Living and dying with Parkinson's disease. *Mov Disord*. 2014;29(13):1571-1573. https://doi.org/10.1002/mds.25955
2. Polatli M, Akyol A, Cildag O, Bayülkem K. Pulmonary function tests in Parkinson's disease. *E J Neurol*. 2001;8(4):341-345. https://doi.org/10.1046/j.1468-1331.2001.00253.x
3. Monteiro L, Souza-Machado A, Valderramas S, Melo A. The effect of levodopa on pulmonary function in Parkinson's disease: a systematic review and meta-analysis. *Clin Ther*. 2012;34(5):1049-55. https://doi.org/10.1016/j.clinthera.2012.03.001
4. Pal PK, Sathyaprabha TN, Tuhina P, Thennarasu K. Pattern of subclinical pulmonary dysfunctions in Parkinson's disease and the effect of levodopa. *Mov Disord*. 2007:22(3):420-424. https://doi.org/10.1002/mds.21330
5. Sathyaprabha TN, Kapavarapu PK, Pall PK, Thennarasu K, Raju TR. Pulmonary functions in Parkinson's disease. *Indian J Chest Dis Allied Sci*. 2005;47(4):251-257.
6. Tamaki A, Matsuo Y, Yanagihara T, Abe K. Influence of thoracoabdominal movement in pulmonary function in patients with Parkinson's disease: comparison with healthy subjects. *Neurorehab Neural Repair*. 2000;14(1):43-47. https://doi.org/10.1177/154596830001400105
7. Brown LK. Respiratory dysfunction in Parkinson's disease. *Clin Chest Med*. 1994;15(4):715-727.
8. Torsney KM, Forsyth D. Respiratory dysfunction in Parkinson's disease. *J R Coll Physicians Edinb*. 2017;47(1):35-39.
9. Seffinger MA, King HH, Ward RC, et al: Osteopathic Philosophy. In: Chila AG, ed.: *Foundations for Osteopathic Medicine*. 3rd ed. Baltimore, MD: William and Wilkins; 2011:4-7.
10. Marszałek S, Niebudek-Bogusz E, Woźnicka E, Malińska J, Golusiński W, Śliwińska-Kowalska M. Assessment of the influence of osteopathic myofascial techniques on normalization of the vocal tract functions in patients with occupational dysphonia. *Int J Occup Med Environ Health*. 2012;25(3):225-235. https://doi.org/10.2478/S13382-012-0041-7
11. Degenhardt BF, Kuchera ML. Update on osteopathic medical concepts and the lymphatic system. *J Am Osteopath Assoc*. 1996;96(2):97-100. https://doi.org/10.7556/jaoa.1996.96.2.97
12. Sleszynski SL, Kelso AF. Comparison of thoracic manipulation with incentive spirometry in preventing postoperative atelectasis. *J Am Osteopath Assoc*. 1993;93(8):834-838, 843-845.
13. Hodge LM, Creasy C, Carter K, Orlowski A, Schander A, King H.H. Lymphatic pump treatment as an adjunct to antibiotics for pneumonia in a rat model. *J Am Osteopath Assoc*. 2015;115(5):306-16. https://doi.org/10.7556/jaoa.2015.061
14. Yao S, Hassani J, Gagne M, George G, Gilliar W. Osteopathic manipulative treatment as a useful adjunctive tool for pneumonia. *J Vis Exp*. 2014;6(87). https://doi.org/10.3791/50687
15. Wells MR, Giantinoto S, D'Agate D, Areman RD, Fazzini EA, Dowling D, Bosak A. Standard osteopathic manipulative treatment acutely improves gait performance in patients with Parkinson's disease. *J Am Osteopath Assoc*. 1999;99(2):92-98.

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16. DiFrancisco-Donoghue J, Apoznanski T, de Vries K, Jung MK, Mancini J, Yao S. Osteopathic manipulation as a complementary approach to Parkinson's disease: A controlled pilot study. *NeuroRehabilitation*. 2017;40(1):145-151. https://doi.org/10.3233/NRE-161400. PMID: 27814309.
17. Seccombe LM, Rogers PG, Hayes MW, Farah CS, Veitch EM, Peters MJ. Reduced hypoxic sympathetic response in mild Parkinson's disease: further evidence of early autonomic dysfunction. *Parkinsonism Relat Disord*. 2013;19(11):1066-1068. https://doi.org/10.1016/j.parkreldis.2013.07.006
18. Yamada H, Murahashi M, Takahashi H, et al. Respiratory function impairment in patients with Parkinson's disease--a consideration on the possible pathogenetic relation to autonomic dysfunction. *Rinsho Shinkeigaku*. 2000;40(2):125-30.
19. Zhao ZH, Bao HD, Tseng CC, Zhu ZZ, Qiu Y, Liu Z. Prediction of respiratory function in patients with severe scoliosis on the basis of the novel individualized spino-pelvic index. *Int Orthop*. 2018 Apr 5. https://doi.org/10.1007/s00264-018-3877-z. [Epub ahead of print]
20. De Pandis MF, Starace A, Stefanelli F, et al. Modification of respiratory function parameters in patients with severe Parkinson's disease. *Neurol Sci*. 2002;23 Suppl 2:S69-S70.
21. Swender DA, Thompson G, Schneider K, McCoy K, Patel A. Osteopathic manipulative treatment for inpatients with pulmonary exacerbations of cystic fibrosis: effects on spirometry findings and patient assessments of breathing, anxiety, and pain. *J Am Osteopath Assoc*. 2014;114(6):450-8. https://doi.org/10.7556/jaoa.2014.095 ■