The effects for Osteopathic manipulative treatment on Parkinson's disease related Symptoms

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Introduction

Parkinson's Disease ("PD") is noted to be the second most prevalent neurodegenerative disorder in the world (Rivera-Martinez at al., 2002). The number of individuals living with PD has been increasing at a rapid rate over the past two decades (Bloem et al., 2021). This makes finding appropriate treatment methods for this disease a very significant issue. Though treatment is mainly reliant on pharmaceuticals, alternative methods such as physiotherapy, occupational therapy, speech therapy and dieticians are considered applicable to the symptomatology (Yao et al., 2013). Osteopathic manipulative treatment ("OMT") itself is also proving to be an effective treatment method for many of the symptoms correlated with PD in humans and animals.

Patients with PD suffer from motor and non-motor impairment due to the neurodegenertive aspects of the disease (Li et al., 2021). This leads to the following motor function symptoms of rigidity, postural instability, bradykinesia (i.e. slow movement), freezing and a resting tremor (McKinley & Perkins, 2019). In addition, pain is another prevalent aspect of PD and has been shown to be present in 59.77% of patients (Rana et al., 2013). Moreover, the symptomatology that coincides with PD significantly impairs the patients quality of life (Li et al., 2021). OMT can be beneficial by combatting the symptoms of PD particularly by slowing down the progression of the disease and reducing the symptoms.

OMT is a treatment method that aims to maintain one's homeostasis by targeting Somatic dysfunctions in their body (Li et al., 2021). Somatic dysfunction refers to the impairment of Myofascial, vascular, skeletal, lymphatic and neurological system function. OMT utilizes

manual techniques to treat these issues through various mobilization methods such as soft tissue stretching, spinal manipulation and visceral techniques (Franke et al., 2014). The benefits for these techniques make OMT a very good prospect for use in addressing many symptoms commonly found in patients with PD.

Unfortunately, animals are also susceptible to experiencing symptoms of this disease. For instance, horses can get toxic equine parkinsonism, which is a neurological disease caused from the ingestion of poisonous yellow star thistle or Russian knapweed (Cheng et al., 2011). The onset of symptoms appear suddenly at any point after the ingestion of the poisonous plants for prolonged periods. The symptoms associated with Toxic Equine Parkinsonism have been associated with those in human PD (Sanders et al., 2001). In humans, 3-5% of PD has been associated with genetic causes, however neurotoxin exposure is another know cause of the disease (Bloem et al., 2021). However, in terms of PD for dogs, it is mainly a hereditary condition, although injury may also play a key roll (Can dogs get Parkinson's disease's, 2020). Motor function symptoms often evident in dogs consist of bradykinesia, restlessness, stiffness, and tremors in one or more legs. These are very similar to the human symptoms observed, hopefully indicating that the benefits of OMT could be fairly interchangeable between the species, however more species specific research needs to be completed.

Effects of OMT on Pain

Given one of the aims of OMT is to relieve pain, indicating that it may be an effective tool in addressing the high prominence of pain experienced by PD patients (Yao et al., 2013). Pain is a

very significant symptom of PD with a study by Rana et al. (2013) indicating that 60% of individuals living with PD experience pain. Another study has indicated that postural deformities related to PD play a large role in contributing to decreased back function and augmented back pain (Li et al., 2021). This pain often ends up negatively affecting many of the biopsychosocial factors of the individual with PD (Degenhardt et al., 2014). Pain itself has been related to difficulties sleeping and completing daily tasks as well as interfering with general mood and relationships with others. Poor quality of sleep has been noted as an aggravating factor in terms of intensifying other issues correlated with PD (Goldfinger et al., 2017)). The most frequently indicated source of pain in PD patients is located in the lower back (Yao et al., 2013). Though not completed on individuals with PD, a study by the Clinical Guideline Subcommittee on Low Back Pain and the American Osteopathic Association in 2010 has indicated that OMT is a significantly effective way of treating and reducing pain in the lower back. This is promising, however more studies need to be completed on the specific effects of OMT on relieving pain specifically in regards to patients with PD.

Osteopathy provides a good option for pain management and may reduce reliance on the potentially harmful medications currently being used. For instance, opioids are still a highly prescribed medication for people experiencing chronic pain (Urtis et al., 2021). This is in spite of their highly addictive qualities and their potential risk for overdose. There are still an increasing number of opioid related deaths in the United States. Unfortunately, the alternative medications available have their own negative side effects (Urtis et al. 2021). In addition to the previously stated risk factors associated with medications there is also an exacerbated potential

for gastrointestinal ulcers as well as bleeding. These medications also tend to not be as efficient in pain management as their opioid competitor. With the risks associated with pain medications, there is an evident need for alternative methods of treatment that limit these potential hazardous outcomes. OMT has shown to be an effective mechanism at treating musculoskeletal pain and providing short term relief (Degenhardt et al., 2014). This reduction of pain may lead to a lower reliance on medication and even decrease the need for invasive procedures (Goldfinger et al., 2017). This not only prevents many of the negative side effects that come with prescription medication but more importantly improves on the individual's quality of life (Degenhardt et al., 2014). These results are hopeful for the future use of OMT as an assistive treatment for pain management and reducing the use of other potentially detrimental treatment methods.

Effects of OMT on Functions and Mobility

Pain is not the only debilitating factor of PD. PD can cause the declining of other body functions, which can have negative effects on the patient. Reduced function and mobility in PD patients is often associated with increased fall risks (Terrell et al., 2022). Following a single session of whole body OMT has been shown to increase sagittal hip range of motion ("ROM") in individuals with PD. Decreased hip, knee and ankle range of motion are regularly evident in PD patients. Therefore, increasing range of motion could potentially assist with patients' hindered walking velocity, stride length and possibly reduce their risk of injury due to falls (Terrell et al., 2022). However, the wavelength analysis completed in one study did not show any significant difference between the baseline sham group, OMT neck down treatment group, and the OMT whole body treatment group, including cranial treatments, when considering joint angles

throughout the gait cycle. More research should be completed to determine the effects rang of motion has on gait motion and fall risks. Additionally, OMT has been shown to increase postural stability in those with PD in comparison to control groups (DiFrancisco-Donoghueet al., 2017). This increase was attributed to the reduced rigidity of muscles allowing the subject to obtain a more upright position, thus altering the individuals centre of gravity promoting a wider and stronger base of support. This could potentially impact fall risk but more studies need to be conducted as this study showed no significant findings in this regard (DiFrancisco-Donoghue et al., 2017). Enhancing the mobility of the musculature is not the only potential benefit of OMT as it also is known to enhance lymphatic circulation in animals (Tobey, H., et al. 2019).

The lymphatic system has recently been shown to interact with the brain through the meningeal lymphatic vessel and the newly discovered glymphatic system (Li, et al., 2022). The glymphatic system utilizes perivascular tunnels to assist in the elimination of microscopic waste products such as metabolites, and soluble proteins from the central nervous system (Krats, 2016). Dysfunctions within this system results in the accumulation of toxic proteins in the brain which in turn contributes to the the development of PD and Alzheimer's (Li et al., 2022). The utilization of Osteopathic Cranial Manipulative medicine technique on rats with Alzheimer’s diseases has been shown to improve spatial awareness and reduce cerebrovascular waste products (Tobey et al. 2019). Though more research is needed to support these finding and attribute them to PD specifically, they are hopeful in regards to the possible positive influence OMT may have on slowing the progression of the disease. Moreover, Lymphatic dysfunctions greatly affect the abundance of the α-synuclein protein which is involved in neuroinflammation

and PD pathogenesis (Liu et al., 2023). This results in a reduced pressure differentiation in regards to inspiration and expiration between the adnominal and the thoracic cavities resulting in a decrease in alveoli gas exchange. Respiratory and cardiovascular issues are highly associated with the suffering and mortality of individuals with PD, with arteriosclerotic heart disease and bronchopneumonia being among the main causes (Yao et al., 2013). OMT targeting and augmenting lymphatic flow has shown positive results on human patients with pneumonia (Yao et al., 2014). These improvements are achieved by OMT enhancing respiratory function, lymphatic contractility, amplifying antibody response, decreasing anemia, increasing leukocytes prevalence in the peripheral blood as well as positively altering thoracic pressure differentials. Thus, OMT should be very beneficial in terms of reducing the morbidity and extending life expectancies of patients with PD.

Motor control is another facet of PD that may benefit from OMT treatment. With PD being a neurodegenerative disease, many motor control issues develop as the disease progresses (Kailua & Lang, 2015). With PD being a hypo-kinetic-movement disorder, it is currently often diagnosed by its observable motor symptoms (Goldfinger et al., 2017). These symptoms include muscular rigidity, decreased facial expressions, postural instability, bradykinesia and even tremors. OMT could provide significant assistance in the reduction of these symptoms. Some recent studies have indicated that OMT is an effective method for improving balance, motor and gait function in individuals with PD (Yao et al., 2020). These studies help indicate that OMT is an efficient assistive therapy in reducing PD's motor symptomatology. Furthermore, OMT may be an efficient method for treating tremors related to PD. A pilot study recently completed at the

New York Institute of Technology College of Osteopathic Medicine has demonstrated the positive results for the effects of OMT on tremors (Li et al., 2018). This is promising for the potential effect that OMT can have in assisting to reduce the progression of tremors associated with PD (Poon et al., 2018). Currently research is looking into the potential effects of OMT on the bradykinesia and dyskinesia symptoms associated with PD. Though current research is limited, it is hopeful as to the many benefits OMT may provide to the many function issues experienced with PD.

Effects of OMT on Quality of life

OMT may additionally be used to improve the mental well-being of individuals coping with PD. PD affects not only the general motor control but also impairs one's cognition and increases levels of depression (Li et al., 2021). Depression has even been noted as one of the most disabling aspects on the quality of life for individuals with PD (Kuopio et al., 2000). Therefore, by enhancing motor control and decreasing the severity of various symptoms associated with the disease we may be able to reduce PD related suicidal thoughts (Hemmerle, et al., 2012). Treating PD patients with osteopathy has been shown to display the greatest success in managing both neurological and motor control symptoms. Furthermore, osteopathy has displayed the greatest effect on the various somatic dysfunctions frequently evident with PD (Li et al., 2021). Specifically addressing the common motor symptoms observed in PD: resting tremors, bradykinesia, stiffness, and postural instabilities debilitating the individual. This demonstrates the effectiveness of OMT in reducing the debilitating symptoms associated with depression and ultimately improving the patient's wellbeing. Through treating the various somatic dysfunctions

osteopathy aims to help the individual maintain their body homeostasis (Li et al., 2021). OMT ameliorates a variety of functions associated with depression including: circulation, metabolic, behaviour, biological and neurological issues. These enhancements have proven that OMT is a significant treatment method that enhances the physical and mental wellbeing of the PD patients, particularly in regards to the motor control over the patient's body and combating of negative thoughts.

Previous research has shown correlations between gut health and the onset of PD through the prevalence of chronic constipation (Mancini et al., 2021). The symptom of chronic constipation has been evaluated in early onset PD prior to the development of visible motor impairments. With known osteopathic benefits on chronic constipation, early treatment with osteopathy could help with slowing the progression of other associated life effecting impairments. Evidence has indirectly correlated gut microbiome imbalances with chronic constipation and the development of PD (Mancini et al., 2021). For instance, actinobacteria has displayed an almost perfect positive correlation with the decrease of daily living experiences with PD. Furthermore, an increase in verrucomicrobia abundances were significantly correlated with the increased severity of gait, mobility, posture, and painful Off-state Dystonia. Significant differences have been observed in chronic constipation associated with PD following 4 weekly treatments of OMT, showing indications of a reduction in Actinobactirai and considerable decreases in the abundance of Verrucomicrobia. This correlation would indicate that through OMT we can positively influence the gut microbial balances potentially slowing symptom progression for PD (Mancini et al., 2021). Many human studies use dogs as trial tests for human replication in terms of PD,

especially relating to gut health. The human gut microbiome has been indicated to most resemble that of a canine as to that of rodents (Ambrosini et al. (2019). Thus, these results are hopeful in terms of OMT treatment on canine's with PD and the potential benefits on other animals and humans living with the disease. However, further research should be done on the effects of OMT on the gut microbiome in correlation with preventing PD symptom onset.

Osteopathy, moreover, assists with enhancing daily living and reducing the speed of the progression of PD-related symptoms. With pain being a very common debilitating factor of PD, alleviating these symptoms could significantly improve the patient's quality of life (Choi et al., 2017). OMT has been shown to have a positive effect on pain with 92% of patience indicating reductions of pain after treatment and 72% indicating that the benefits are lasting up to 7 days post-treatment (Degenhardt et al., 2014). Additionally, PD patients have heightened fall risks due to rigidity and decreased range or motion creating disturbances in their gait (Terrell et al., 2022). The use of OMT has been shown to significantly increase hip range of motion following just one session. Subsequently, OMT patients have indicated that enhancements made through the treatments transferred to improvements in completing daily living tasks (Snider et al., 2007). Given that PD is non-curable, the methods of treatment focus on minimizing symptoms and slowing the progression of the disease (Li et al., 2021). For example, paraspinal muscle stretching, a technique utilized by OMT, is thought to slow the degeneration of the multifidus muscle improving limb control and spinal stability. Therefore, by improving signs and slowing degenerative progression of the disease, OMT offers a great assistive therapy for PD patients. However, the exact effects of each type of manipulations were not measured in this study,

therefore, future studies should be done focusing on the possible benefits of each technique and the associated reasoning behind them.

Discussion

OMT's effectiveness on addressing pain makes it a very promising method of treatment for PD. PD patients experience biopsychosocial effects associated with pain and in turn experience reduced quality of sleep, general mood and relationship issues (Degenhardt et al., 2014). Given the positive results on the use of OMT to treat lower back pain, very commonly indicated by PD patients, there is promise for the effects of OMT reducing pain in individuals with PD. However, specific studies should be conducted to confirm the effectiveness of treating PD related pain symptoms. The significant difficulty in addressing pain in PD is the considerable reliance on pharmaceutical medication with potentially harmful side effects (Urtis et al. 2021). Additionally, given the indicated benefits of OMT on providing short term relief on muscular pain there is hopefully the potential to reduce patients' reliance on much more potentially harmful and addictive outcomes (Degenhardt et al., 2014). Therefore, OMT application for pain management in PD seems to have great potential for reducing the negative outcomes associated with pain and the current reliance on pharmaceuticals to attempt to resolve these issues.

The benefits of OMT on function has shown to be very promising in assisting with mobility issues in PD. Patients with PD suffer from mobility issues which intern increase their risk of falls that can lead to death (Terrell et al., 2022). Though one study did not indicate any change in range of motion or mobility, the quality of life of those with PD was still enhanced (Snider et al,

2007). OMT has also been shown to augment postural stability suggesting it may be beneficial in assisting with functional issues in regards to the neurological, biomechanical and behavioural affects of PD (DiFrancisco-Donoghueet al., 2017). On another note, the newly discovered glymphatic system dysfunction has been related to the onset of Alzheimer's and PD (Li et al., 2022). OMT on rats has indicated a positive results on reducing cerebrovascular waste products (Tobey, H., et al. 2019). This may indicate that OMT's benefits on the lymphatic and circulatory systems may help reducing toxic metabolic waste build up (Tobey, H., et al. 2019). The effects of OMT on enhancing lymphatic flow have also been correlated with reducing mortality due to bronchopneumonia and arteriosclerotic heart disease (Yao et al., 2013). Moreover, OMT assists with improving balance, gait and motor function in individuals living with PD. There have also been recent indications that OMT has a positive effect on reducing tremors caused by PD (Li et al., 2018). Overall, the evidence seems to suggest that OMT is a very promising and beneficial treatment for the functional impairments commonly experienced with PD.

The use of OMT to address the negative impact that PD has on the overall quality of life has shown to have some positive outcomes. Depression has been noted as one of the most disabling aspect on the quality of life for those living with PD (Kuopio et al., 2000). OMT has shown to have circulatory, metabolic, biological, behavioural, and neurological benefits which are highly correlated with depression (Li et al., 2021). Through alleviating various issues associated with depression, OMT offers great potential for enhancing and prolonging the quality of life patients with PD. Moreover, OMT can also improve chronic constipation often impacting the quality of life of individuals with PD prior to the prevalence of motor symptoms (Mancini et al., 2021).

Chronic constipation is an ailment that has been associated with Parkinson's onset through gut microbiome imbalances (Mancini et al., 2021). With the use of OMT improving gut microbial balances there is potential for slowing the progression and onset of other PD symptoms. Furthermore, OMT seems to be an effective treatment method for pain and mobility issues in Parkinson's disease. With one study indicating pain being reduced in 92% of patience and the benefits lasting up to 7 days post treatment (Degenhardt et al., 2014). OMT has also been shown to improve hip range of motion with the results seeming to indicate a greater ease with daily living tasks (Snider et al., 2007). By reducing pain and increasing mobility, OMT is further proving to be an effective treatment method for enhancing the quality of life for those with PD.

Limitations

Though the research done up to this point is quite promising there are still many limitations to consider. The subject size for these studies varied greatly, with some smaller sizes possibly skewing the results. The number of treatments and length of follow up interactions also varied greatly between studies. These studies were also conducted on a variety of different animals, including rats, humans and dogs, so more species specific test should be conducted. There are limited studies in regards to each facet of OMT and its benefits in specific to PD symptomatology. Some studies were more discrete on the osteopathic treatment type used than others making the results potentially more difficult to repeat. Specific technique classifications should be made to help specify which technique or multitude of techniques best address each issue. Another limitation to this research paper is access to various journals, so some related

articles were unable to be reviewed due to lack of access. In the future, long term studies should be conducted to determine the potential preventative effect OMT may have in the onset of any symptoms in the general populous.

Conclusion

In conclusion, the previous research utilized in this paper seems to demonstrate the positive effects of OMT on patients with PD. The utilization of OMT to reduce the high prevalence of pain in individuals with PD seems very promising. Moreover, not only does OMT seem to reduce pain but also improves the overall mobility and function of PD patients. Ultimately, this leads to an increase in quality of life for those coping with this non-curative disease. This would indicate that OMT is an efficient mode of treatment in regards to addressing the many indicators associated with PD in humans and animal specimens.

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