A CASE STUDY: COMBINATION OF PHYSIOTHERAPY AND OSTEOPATHIC MANUAL THERAPY TECHNIQUE IN THE MANAGEMENT OF PIRIFORMIS SYNDROME

A Thesis submitted in Partial Fulfilment of the Requirements for the Degree of Doctor of Physiotherapy (DPT)

in

National University of Medical Sciences (NUMSS) USA

29th May 2020

By

Ifeoluwa S. Popoola, PT

Student No. U 1809006

ifepopoola@yahoo.co.uk

ACKNOWLEDGMENTS

Firstly, I would like to appreciate God Almighty for grace and favour He granted me in pursuance of this program. My lovely wife, family members and all well-wishers for support and encouragement.

I also thank NUMSS for creating this educational platform making furtherance of educational career financially comfortable.

Finally, I really appreciate Mr Kingsley Nwankwo Msc.PT including staff of Fitness Global Consult physiotherapy clinic for their supportive role and my amiable Dr Pourgol for enthusiastically and passionately imparting his knowledge and osteopathic / business management skills through his lectures. I say THANK YOU Sir.

A CASE STUDY: COMBINATION OF PHYSIOTHERAPY AND OSTEOPATHIC MANUAL THERAPY TECHNIQUES IN THE MANAGEMENT OF PIRIFORMIS SYNDROME

Background

Piriformis syndrome is a neuromuscular condition characterized by pain in hip, buttock and may even refer to lower back and thigh (Lori A. *et al.,* 2008; Jason C.T *et al*., 2010), as a result of shortening or spasm of the piriformis muscle resulting in compression of sciatic nerve (Jason C.T., *et al.,* 2010). The sciatic nerve entrapment in piriformis muscle is usually at the greater sciatic notch (Sureshan *et al,* 2012) and is nondiscogenic in origin. The term "piriformis syndrome" was introduced by Robinson, which he described as sciatica due to abnormal muscle, usually traumatic in origin (Robinson, 1947). It is often unrecognized or misdiagnosed in clinical settings and its diagnosis accepted only after other cause of pain arising in the buttocks or lower limbs have been eliminated (Michel *et al*, 2013). Patients often imprecisely describe the pain while being considered a pain in the hip, tailbone, buttock or groin, and often down the back of the leg.

Studies (Pace and Nagle, 2004; Lori A et al., 2008) show an incidence rate of PS among patients diagnosed with low back pain to be between 5% and 36% and with a female: male ratio of 6:1 (Cramp *et al*., 2007). This may possibly be because of the biomechanics associated with wider quadriceps femoris muscle angle (i.e. Q angle) in the os coxae of women (Pace and Nagle, 1976). PS is subdivided into primary and secondary forms: Primary PS (less than 15% of cases) has an anatomic cause, such as a split piriformis muscle, split sciatic nerve, or an anomalous sciatic nerve path (Pecina et al, 2008). Secondary PS occurs as a result of a precipitating cause, including macro trauma to the buttock producing soft tissue inflammation, spasm of muscle, or both which results in compression of nerve. Micro trauma may also result from overuse of piriformis muscle such as in long-distance walking or running or by direct compression, ischemic mass effect, and local ischemia (Lori A. et al., 2008). Delay in diagnosing may lead to pathologic conditions of the sciatic nerve, chronic somatic dysfunction, and compensatory changes resulting in pain, paresthesia, hyperesthesia, and muscle weakness. The challenge for clinicians is to recognize symptoms and signs that are unique to piriformis syndrome, enabling appropriate treatment in a timely manner.

Various treatments have been described for the management of PS including surgical (Benson and Schutzer, 1999; Suk *et al,* 2017), pharmaceutical and nonpharmaceutical (physiotherapy and

manual osteopathic techniques) (Lori et al, 2008; Waqar *et al*, 2012). The management of PS includes NSAIDs, correction of ankle or postural problems, limb length discrepancy, , life-style modifications, stretching, muscle energy technique (MET), strengthening, core training, electrotherapeutic modalities, surgical decompression of sciatic nerve among others (Cramp F et al., 2007; Jason C.T. et al., 2010).

Prominent among these interventions are the nonpharmaceutical approaches which include physiotherapy and manual osteopathic techniques. Studies have described the effectiveness of physiotherapy and manual osteopathic techniques as stand-alone treatments for the management of PS (Lori et al, 2008; Waqar *et al*, 2012). However, the efficacy of the combined use of physiotherapy and osteopathic techniques in the management of PS is yet to be determined and documented. The aim of this study is to determine the efficacy of a combined physiotherapy and manual osteopathic techniques for the management of piriformis syndrome in a single participant.

Method

The study was conducted at Fitness Global Consult physiotherapy clinic, an outpatient clinic in Abuja, Federal Capital Territory, Nigeria. Prior to assessment, the aim of the study was extensively explained to the participant for his agreement to take part in the study. Participant reviewed the entire study process and agreed to sign an informed consent form.

Case presentation

A 48 years old male walked into the clinic with an antalgic gait and complaint of low back and right buttock pain for the past 12 days. Pain is exacerbated with prolonged sitting, walking, turning in bed, stair activities. He is a bank worker whose job description requires sitting for approximately five (5) hours daily for 5 times a week. His body weight was 98 kilogram, height 178 centimeter and body mass index (BMI) of 30.91kg/m^2. The symptoms got worsened in the last 2 days that he consulted an orthopedic surgeon for the same complains. Radiological examination of the lumber spine was performed as per the advice of the orthopedic surgeon which revealed normal findings. Analgesic treatment was prescribed for one week and he was referred to physiotherapy on the same day for further examination and management.

The participant reported to our facility on the same day. After thorough analysis of case reports, the initial assessment was made on 12th day since the onset of symptoms. The assessment revealed pain and tenderness over the sacroiliac joint, greater sciatic notch, right piriformis muscle, decrease in hip joint active and passive ROM (abduction, external and internal rotation), tightness as well as weakness of ipsilateral piriformis muscle, mild antalgic gait and asymmetrical weakness of right lower limb right . Screening of lumbar spine, sacroiliac and hip joints ruled out presence of any contributing pathology. Clinically, piriformis sign, Freiberg sign, Beatty test, Pace sign, FAIR test and lasegue sign were performed and found positive test except for the lasegue test that was negative. The pain, tenderness, tightness and weakness of piriformis muscle, reduced hip abduction and internal rotation and lower limb function was the initial working hypothesis to

design the treatment protocol. The clinical diagnosis of PS was confirmed with the presence of: (1) Pain and tenderness over piriformis muscle, (2) Weakness of ipsilateral piriformis muscle, (3) Difficulty in prolong sitting, walking, stair activity, (4) Reduce rotational hip range of motion (5) Positive test in; (a) piriformis sign (b), Freiberg sign, (c) Beatty test,(d) FAIR test (e) PACE sign (Lori A *et al*., 2008; *Jason et al*., 2010; Kevork Hopayian *et al*., 2010; Nseka and Tabansi-Ochiogu 2019).

Test and Measures

The participant was assessed at baseline (day 1) and subsequently at post intervention (4th, 7th and 10th treatment sessions) with visual analog scale (VAS), hip joint goniometry and lower extremity functional scale. Pain intensity was measured with a 10 centimeters visual analog scale (VAS) ranging from "0" no pain to "10" the worst pain in last 24 hour (Khuman *et al.* 2014). Range of motion of hip abduction and internal rotation was assessed using full circle goniometer (360º) (Richard L Gajdosik and Richard W Bohannon, 1987). The hip abductors and external rotators were assessed for strength using manual muscle testing (MMT) (Jason C. Tonley et al., 2010; Leon Chaitow, 2006) and found to be grade 3 at baseline as compared to the contralateral lower limb. Lower extremity functional scale (LEFS) was used to assess the functional status of lower limb in relation to symptoms in buttock. LEFS consists of 20 questions related to ability of person to perform everyday tasks. The LEFS has maximum score of 80 points where lower the score greater the disability. LEFS has proven to be reliable in various lower limb conditions. (Binkley *et al*., 1999; Tonley *et al*., 2010).

Experimental Procedure

The participant visited 10 times over 14 days for treatment and data collation. In this single subject A-B study design, the participant underwent 4 data collection phases and 10 treatment sessions. Baseline assessment (phase A) and data collation was done on day 1 and without any treatment intervention. Intervention (phase B) commenced on the 2nd day after the completion of baseline assessment and consisted of 10 daily treatment sessions along with data collation after every 3rd session.

Baseline Phase (A)

Baseline assessment and data collation was done on the first day of visit after informed consent was given by participant. This procedure took about 55 minutes to complete. Second data for phase A (Day 1A) was collated prior to commencement of phase B.

Treatment Phase (B)

The participant received 10 treatment sessions which lasted for approximately 25 minutes per session for a period of 14 days. The intervention program (Table 1) was intended on reducing pain in piriformis muscle and its relative changes in hip joint range of motion especially the rotatory

components as well as to restore function of lower extremity. Reciprocal inhibition muscle energy technique (RI-MET) as described by Chaitow (2006) combined with therapeutic ultrasound were the choice manual osteopathic and physical therapy techniques used respectively to improve pain, length and function of piriformis muscle. Participant was reviewed and data collated on the 4^{th}, 7^{th} and 10^{th} day.

Given to the mild tenderness of the piriformis muscle, pulsed mode ultrasound was used for some treatment sessions after which continuous mode was introduced subsequently (table 1). Therapeutic ultrasound (US) was applied for 5 minutes daily while participant was in a prone position. After the application of US, reciprocal inhibition muscle energy technique was applied and with frequency and intensity progressed in the course of the study.

Table 1: Intervention program

INTERVENTION	
Treatment	**Description**
	1st to 3rd Treatment sessions
Ultrasound	In prone position, applied to the gluteal region for 5 minutes (Pulse ratio 1:4, frequency 1MHz, Intensity 0.5W/cm2
RI-MET	Starting position at first point of resistance, patient applies approximately 20% of strength, hold for 7-10 sec, 2 sets
	4th to 6th Treatment sessions
Ultrasound	In prone position, applied to the gluteal region for 5 minutes (Pulse ratio 1:2, frequency 1MHz, Intensity 0.5W/cm2
RI-MET	Starting position at first point of resistance, patient applies approximately 25% of strength, hold for 7-10 sec, 3 sets
	7th to 10th Treatment sessions
Ultrasound	In prone position, applied to the gluteal region for 5 minutes (Pulse ratio 1:1, frequency 1MHz, Intensity 0.8W/cm2)
RI-MET	Starting position at first point of resistance, patient applies approximately 30% of strength, hold for 7-10 sec, 4 sets

Data Analysis

Data was analyzed using bar chat and statistical analysis method to show outcome of RI-MET and therapeutic ultrasound in the management of PS. Statistical package for social sciences version 15 (SPSS 15) was used for descriptive statistics of mean, standard deviation and bar chart.

RESULTS

Visual analysis of VAS, ROM and LEFS data (Table 2) (Figure 1-4) show change in variability of data point from A to B phase, suggesting more improvement in phase B. Changes in data point level from across the different assessment days in phase B (Day1A: VAS=9; ABD=12º; IR=17º; LEFS=5) to first point in B phase (Day 4: VAS=6; ABD=20º; IR=21º; LEFS=22). Mean level of phase A data point (VAS=9; ABD=12.5º; IR=17.5º; LEFS=5.5) were changed in phase B (VAS=3.67; ABD=27.33º; IR=30.0º; LEFS=45.67) suggesting change in outcome scores after the initiation of interventions. Change in trend was noted in all variables in phase B (Fig. 1-4) showing greater rate of change in intervention phase.

Table 2: Baseline assessment and treatment outcome

Phase	Pain intensity	Hip Goniometry (º)		Function
	VAS	ABD	IR	LEFS
Phase A				
Baseline	9	13	18	6
Day 1A	9	12	17	5
Mean (SD)	9	12.5±0.7	17.5±0.7	5.5±0.7
Phase B				
Day 4	6	20	21	22
Day 7	4	29	30	48
Day 10	1	33	39	67
Mean (SD)	3.67±2.52	27.33±6.66	30.00±9.0	45.67±22.59

***VAS=** Visual analogue scale **ABD=**Abduction **IR=** Internal rotation **LEFS**= Lower extremity function scale

Fig. 1: Bar chart showing variation in pain intensity

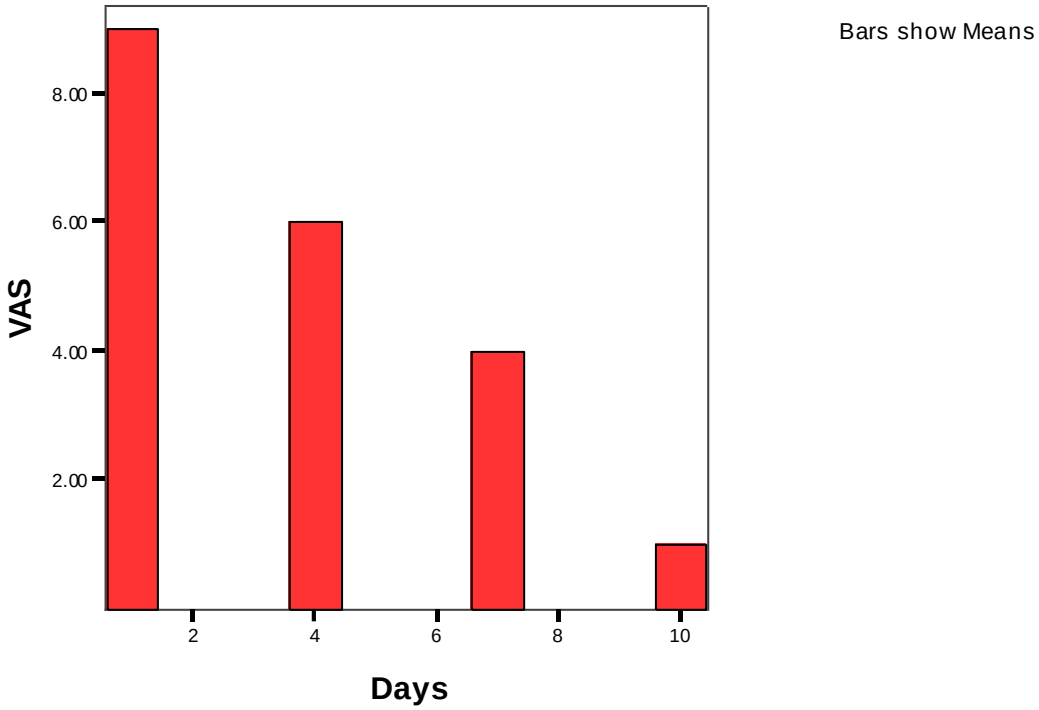


Fig. 2: Bar chart showing improvement in lower extremity function

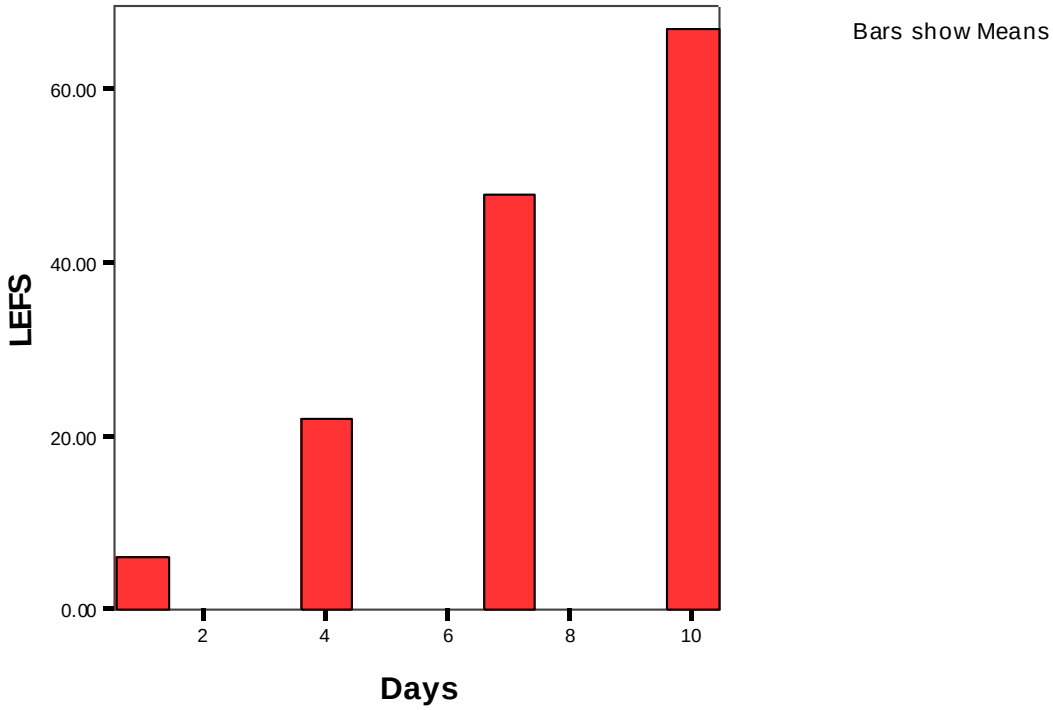


Fig.3: Bar chart showing progression in ROM of hip abduction

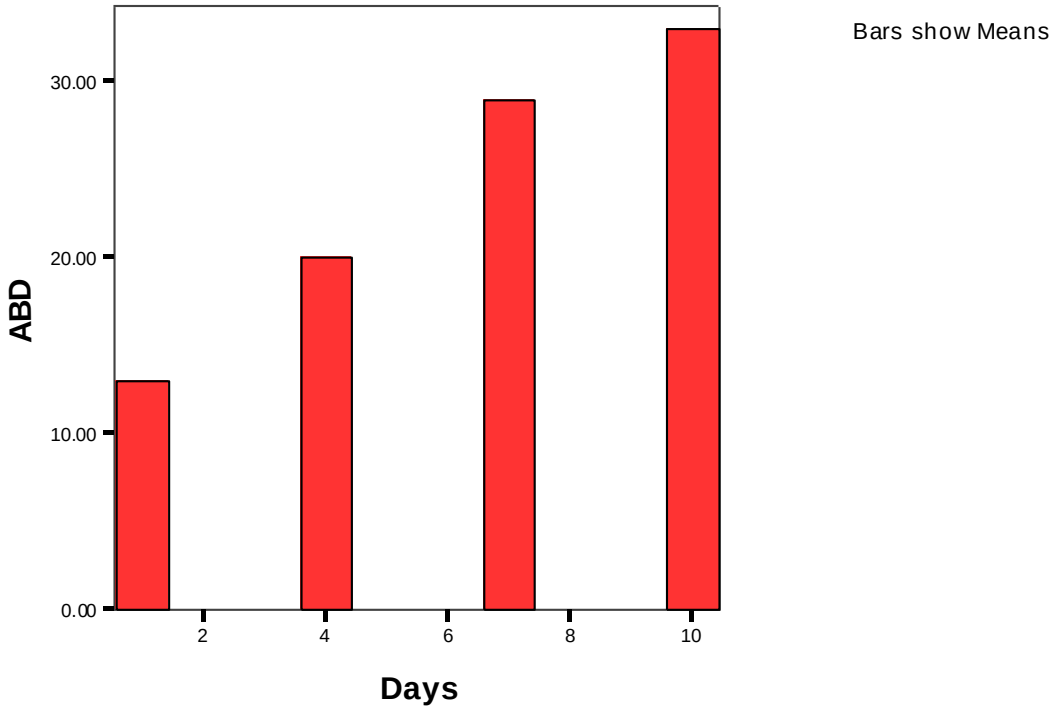
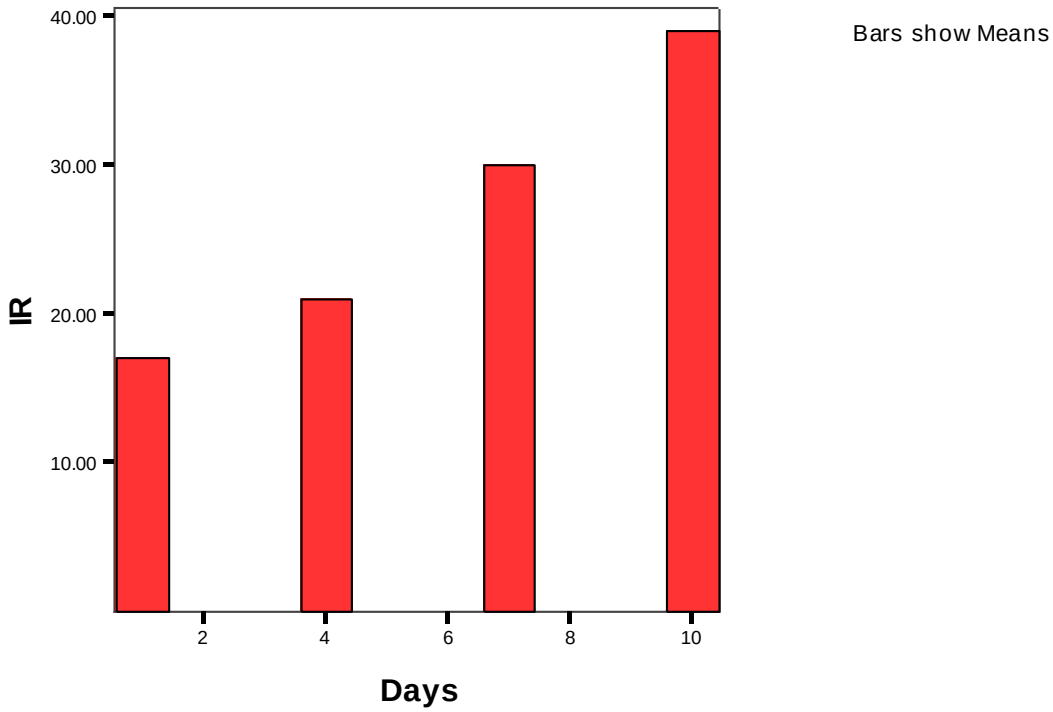


Fig. 4: Bar chart showing progression in ROM of internal rotation



Discussion

The purpose of this study was to investigate the effect of combined physiotherapy and osteopathic manual therapy in the management of piriformis syndrome. The result shows improvement in the treatment outcome of the variables studied. This is in congruence with the findings of other studies which indicated that therapeutic ultrasound and RI-MET are effective in the reduction of pain intensity, increased ROM and improved function in patients with musculoskeletal dysfunctions such as piriformis syndrome (Darmus *et al*., 2010; Khuman *et al.* 2014; Nambi, 2018; Rohit A. *et al.* 2019). The reduction in pain intensity from 9 to 1 on VAS showed the effectiveness of combined physiotherapy and manual osteopathic therapy in the management of pain among patients diagnosed with piriformis syndrome. Physiotherapy and manual osteopathic therapy has been each, reported in several studies (Fisherman et al., 2002; DiGiovanna, Schiowitz, and Dowling, 2005; Lori et al., 2008; Tonley *et al*., 2010; Vani and Pavithra 2019) as a stand-alone treatment for the management of piriformis syndrome. However, no study was seen to have reported such a tremendous reduction in pain intensity while utilizing a combination of physiotherapy and manual osteopathic therapy over a period of 10 treatment sessions in 14 days. Khuman *et al* (2014) reported near-similar improvement in pain intensity but within 12 treatment sessions and in 16 days while utilizing only osteopathic approach. The reason for the consistent decline in the pain intensity as shown in figure 1 could be attributed to the combined therapy applied by the researcher, the dosage of therapy and the intensity of the intervention.

The consistent increase in ROM of hip abduction (from13º to 33º) and internal rotation (from 18º to 39º) also shows the effectiveness of our intervention in the improvement of hip joint ROM among patients with piriformis syndrome. RI-MET have been shown to be very effective in improving joint ROM. The RI-MET procedure involved isometric contraction of muscles which are antagonistic to piriformis muscle. When a muscle or groups of muscles contract isometrically, it leads to inhibition of its antagonist muscles, hence reducing muscle tone (Chaitow, 2006). Isometric contraction of the antagonist to shortened piriformis muscle induced a degree of ease and lengthening of tight piriformis muscle invariably leading to increased hip ROM in this participant. This is comparable with the findings from other studies (Chaitow, 2006; Khuman, 2014) that have reported the effectiveness of RI-MET on the improvement of joint ROM.

The reduction in pain intensity and increase in hip ROM in abduction and internal rotation could be said to be the reason for improved functional recovery of participant. Participant's functional use of the lower limb improved as the mean lower extremity function score rose from 5.5 at baseline to 45.67 in the course of the treatment. This increase in functional recovery may be attributed to the inverse relationship that exists between pain and functional recovery (Rodriguez

et al, 2015; Haugen *et al*. 2016; Myung and Ji, 2019) and ROM and functional recovery (Beissner, Collins and Holmes, 2000; Jung and Yamasaki, 2016). Pain and ROM has been reported in studies (Kjeken *et al.* 2005) to lead to activity limitation and participation restriction which consequently influences functional recovery.

The researcher acknowledges the limitations associated with single case study design. The number of treatment sessions provided might not have been sufficient enough to restore full hip joint ROM and functional recovery as the participant claimed to be pain-free and as such did not continue further. Had it been more, it could have resulted in greater improvements in joint ROM and function. The result of this study cannot be generalized as a management of piriformis syndrome as it was conducted on a single participant. Despite the above limitations, our study provides the first evidence on the effectiveness of combined physiotherapy and manual osteopathic therapy in the management piriformis syndrome. Future randomized controlled studies with larger sample size are warranted to compare the short and long term effectiveness of different variations of muscle energy technique in different stages of piriformis syndrome.

CONCLUSION

The result of this single-case study suggests that combined physiotherapy and manual osteopathic therapy may be an effective strategy in the management of piriformis syndrome.

REFERENCE

1. Beissner K.L., Collins J.E. and Holmes H. 2000. Muscle force and range of motion as predictors of function in older adults. *Phys Ther*. 80(6):556–563.
2. Benson E.R. and Schutzer S.F. Posttraumatic piriformis syndrome: diagnosis and results of operative treatment. *J Bone Joint Surg* (U.S.), 1999
3. Boyajian-O-Neill L.A., McClain R.L., Coleman M.K., and Thomas P.P. 2008. Diagnosis and management of piriformis syndrome: An osteopathic approach. *The journal of the American Osteopathic Association.* 108(11): 657-654.
4. Chaitow L. 2006. Muscle Energy Techniques. 3rd ed. UK: Elsevier Health Sciences.
5. Cramp F, Bottrell O, Campbell H, Ellyatt P, Smith C, Wilde B. 2007. Non-surgical management of piriformis syndrome: a systematic review. *Physical Therapy Reviews*. 12(1): 66-72.
6. DiGiovanna E.L., Schiowitz S. and Dowling D.J, eds. 2005. An Osteopathic Approach to Diagnosis and Treatment. 3rd ed. Philadelphia, Pa: Lippincott Williams & Wilkins.
7. Durmus D., Akyol Y., Cengiz K. *et al.* 2010. Effects of therapeutic ultrasound on pain, disability, walking performance, quality of life, and depression in patients with chronic low back pain: A randomized, placebo controlled trial. *Archives of rheumatology*. 25 (2)
8. Fishman L.M., Dombi G.W., Michaelsen C., Ringel S., Rozbruch J., Rosner B., et al. 2002. Piriformis syndrome: diagnosis, treatment, and outcome—a 10-year study [review]. *Arch Phys Med Rehabil*. 83:295-301.

9. Haugen A.J., Grøvle L., Brox J.I., Natvig B. and Grotle M. 2016. Pain-related fear and functional recovery in sciatica: results from a 2-year observational study. *Journal of pain research*. 2016 (9): 925-931
10. Jason C.T., Steven M.Y., Ronald J.K *et al.* Treatment of an Individual With Piriformis Syndrome Focusing on Hip Muscle Strengthening and Movement Reeducation: A Case Report. *J Orthop Sports Phys Ther.,* 40 (2):103–111. 2010.
11. Jung H. and Yamasaki M. 2016. Association of lower extremity range of motion and muscle strength with physical performance of community-dwelling older women. *Journal of physiological anthropology*. 35: 30
12. Kevork Hopayian,Fujian Song, Ricardo Riera et al. 2010. The clinical features of the piriformis syndrome: a systematic review. *Eur Spine J.* 19(12): 2095–2109.
13. Khuman P.R., Surbala L., Dusad G., Jadeja S. and Chandrabharu V. 2014. Effect of reciprocal inhibition muscle energy technique in acute piriformis syndrome: a single case study. *International Journal of Recent Scientific Research*. 5 (10): 1794-1798
14. Kjeken I., Dagfinrud H., Slatkowsky-Christensen B., Mowinckel P., Uhlig T., Kvien T.K. and FinsetA. 2005. Activity limitations and participation restrictions in women with hand osteoarthritis: patients' descriptions and associations between dimensions of functioning. *Ann Rheum Dis.* 64:1633–1638
15. Lori A.B.O., Rance L.M., Michele K. C., *et al*. Diagnosis and management of piriformis syndrome: an osteopathic approach. *J Am Osteopath Assoc.*, 108:657-664. 2008.
16. Marlies V., Ajay U. *et al.* 2014. Piriformis Syndrome. http://www.physiopedia.com/Piriformis_Syndrome (accessed 04 May, 2020).
17. Michel F, Decavel P, Toussirot E, Tatu L, Aleton E, Monnier G, *et al.* The piriformis muscle syndrome: IJESC, July 2019 23328 http://ijesc.org/ diagnostic criteria and treatment of a monocentric series of 250 patients. *Ann Phys Rehabil Med*: 56:371-383. 2013
18. Myung K.L. and Ji, H.O. 2019. The relationship between pain and physical function: Mediating role of sleep quality, depression, and fatigue. *J Gerontol Nurs*. 45(7):46-54.
19. Nambi G. 2018. Effect of reciprocal inhibition and post isometric relaxation; types of muscle energy technique in piriformis syndrome? A comparative study. *Phys Med Rehabil Res.* 3 (1).
20. Nseka E.G. and Tabansi-Ochiogu C.S. 2019. Differential diagnosis of piriformis syndrome and its implication for physiotherapy. *International journal of Engineering and computing*. 9 (7): 23324- 23329.
21. Pace J.B. and Nagle D. 1976. Piriformis syndrome. *West J Med*.124:435-439.
22. Pecina H.I, Boric I., Smoljanovic T., Duvancic D., Pecina M. 2008. Surgical evaluation of magnetic resonance imaging findings in pririformis muscle syndrome. *Skeletal Radiol*. 37: 1019-23.
23. Robinson D. 1947. Piriformis syndrome in relation to sciatic pain. *Am J Surg.* 73:356-358

24. Rodriguez J.C., Dzierzewski J.M., Fung C.H., Jouldjian S., Josephson K.R., Mitchell M.N., Song Y., Martin J.L. and Alessi C.A. 2015. Association between pain and functional independence in older adults during and after admission to rehabilitation after an acute illness or injury. *J Am Geriatr Soc.* 63(11): 2275–2281.
25. Rohit A., Chang K.V., *et al.* 2019. Therapeutic ultrasound for chronic pain management in joints: A systematic review (published online ahead of print, 2019 May 16). *Pain Med.* Pnz 102. Doi.10.1093/pm/pnz102.
26. Suk K.H., Yong S.K., Tae H.K., and Soo H.K. Surgical Treatment of Piriformis Syndrome. *Clin Orthop Surg*. 9:2. 2017
27. Sureshan S., Eugene S., Patrick W. and Mark D.M. Mercer's Textbook of Orthopaedics and Trauma.10th Ed. Edward Arnold (Publishers) Ltd. 2012.
28. Tonley J.C., Yun S.M., et al. 2010. Treatment of an individual with piriformis syndrome focusing on hip muscle strengthening and movement re-education: a case study. *J Ortho Sports Phys Ther*. 40(2): 103-111.
29. Vani V. and Pavithra S. 2019. Effectiveness of muscle energy technique versus stretching in subjects with piriformis syndrome. *International Journal of Physiotherapy and Research.* 7(5): 3252-3256
30. Waqar A.A., Muhammad N.B., Shaukat A. and Usman J. The effectiveness of electrotherapy with manual therapy in the treatment of piriformis syndrome. *International Journal of Rehabilitation Sciences.* 1:16-19. 2012