

Research Article

Sacroiliac joint manipulation helps to improve pain pressure threshold in chronic piriformis syndrome: a 6-week randomized controlled trial

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ABSTRACT

Background: Piriformis syndrome (PS) has negative impact on the daily activities of the patients and lead to disability. There is an anatomical association of piriformis muscle with sacroiliac joint (SIJ). So manual therapy including manipulation of SI joint may be the option for relieving the symptoms of PS.

Objective: To investigate the effectiveness of Sacroiliac joint manipulation in improving pain pressure threshold in patients with chronic piriformis syndrome.

Materials and Methods: A randomized clinical trial (NCT04603703) was conducted at Max Rehab and Physical Therapy Centre G8-Markaz, Islamabad, Pakistan. A total of n=30 patients were randomly divided into Experimental group (n=15) and control group (n=15). Both groups received conventional physical therapy including therapeutic ultrasound, moist hot pack, piriformis muscle stretching, myofascial release of paraspinal muscles, gluteal strengthening, sciatic neurodynamics. The experimental group additionally received sacroiliac joint manipulation. The outcome measures were pain, straight leg raise (SLR), pain pressure threshold and piriformis muscle length. The total time frame of the treatment was 3 days per week for 6 weeks and pre and post intervention assessment was done.

Result: The mean age of participants was 40.46 ±10.513 years. Pain, SLR, pain pressure threshold and piriformis length was significantly improved (p<0.001) in both the experimental and control group after 6th week intervention. Between group comparison there was no significant difference between the groups after 6-week intervention regarding the pain, SLR and piriformis muscle length, except pain pressure threshold which was significantly improved in experimental group as compared to control group (67.7±18.42 vs 52.51±15.26, p=0.020).

Conclusion: Addition of the sacroiliac joint thrust manipulation technique and conventional physical therapy alone were equally effective in decreasing pain intensity and normalizing length of Piriformis and Straight leg raise. But SIJ manipulation showed promising results on pain pressure threshold.

Keywords: Articular, physical therapy modalities, piriformis muscle syndrome, pain threshold, range of motion, sacroiliac joint.

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INTRODUCTION

Piriformis syndrome is a chronic mechanical fault which develops whenever the prolonged sitting postures put continuous pressure on the muscle belly resulting in spasm and inflammation of piriformis muscle which ultimately compresses the sciatic nerve and gives radiating pains down the leg [1,2]. Tenderness over piriformis muscle and ipsilateral pain in buttock is the most common symptom of piriformis syndrome with or without sciatica [3,4,5].

The symptoms got worsen with sitting in crossed leg position or by walking [6]. Other etiological factors can also be there involving chronic over load, over work tiredness, radiating pains to limbs and major injuries are that may activate Trigger Points in skeletal muscle [7]. Trigger points in this muscle in the muscle may be further developed by the SIJ malfunction and this can be the factor to worsen the normal function. So, in these conditions, both concerns should must be addressed [8,9].

Diagnosis is made by clinical findings such as MRI but many anatomic variants may have gone undiagnosed in the past due to the lack of or limitations of imaging studies [10,11]. An advanced technique of MR neurography may also be useful in assisting the diagnosis of this condition. MR neurography uses high-resolution sequences that increase the signal of peripheral nerves, which allows for increased accuracy and visualization [12].

Many non-pharmacological management techniques used to treat piriformis syndrome includes diverse manual therapy techniques, Piriformis muscle stretching and Kinesiotaping [13,14,15]. The heat therapy, cold therapy, Ultrasound and electric current have been suggested as additional modalities to reduce pain [16]. Dry needling with minimal invasion is used to deactivate the myofascial trigger point which helps to release the pain [17]. Manipulation Techniques are mostly used in SIJ if the source of pain and dysfunction in SIJ is PS. In early studies it is shown that decreased muscle inactivity, increased efficiency of the muscles around the SIJ, balanced Gait pattern, decrease pain intensity and improved ROM are the physiological and functional outcomes of SIJ Manipulation [14, 18].

Several research were done to measure the effectiveness of sacroiliac joint thrust manipulation technique in the treatment of sacroiliac joint

dysfunction, Sacroiliitis, symptoms associated with low back pain or in any other hip pathology, but no research was done to measure the effectiveness of sacroiliac joint thrust manipulation in patients with chronic piriformis syndrome. As there is a strong anatomical relation between piriformis muscle and sacroiliac joint so, the main aim of this study was to measure the effectiveness of HVLAT on SIJ in those patients who are suffering from chronic piriformis or piriformis non traumatic dysfunction to reduce pain intensity, pain pressure threshold and to improve straight leg raise and piriformis length.

METHODOLOGY

A single blinded randomized control trial (NCT04603703) with parallel design at Max Rehab and Physical Therapy Centre G8-Markaz, Islamabad, Pakistan after the approval from research and ethical committee (REC) of faculty of rehabilitation and allied health sciences Riphah International University. The participants were recruited using nonprobability purposive sampling technique from May 2020, to September 2020.

Both genders were eligible for the study with age between 30 to 60 years having at least 3 months old chronic piriformis syndrome as well as with positive Flexion Adduction Internal rotation test (FAIR) and unilateral or bilateral piriformis syndrome. Participants were excluded if they had Lumbar Prolapsed Intervertebral Disc (PIVD), Hip Osteoarthritis, Sacroiliitis, Lumbosacral instability, any joint replacements in lumbosacral and hip region.

A total n=30 participants fulfilled the inclusion criteria were randomly divided into control (n=15) and experimental group (n=15). The randomization was done using toss and coin method. The random allocation sequence was generated by primary investigator (physical therapist), who enrolled participants, as well as assigned participants to interventions. (Figure 1) The participants were assessed before the treatment and after last session at 6th week (18th session). The Numerical Pain Rating Scale (NPRS) used to measure the pain threshold in patients [19]. The Digital Goniometer (Digital Angle Ruler) used to measure the piriformis muscle length and joint range of motion [20]. Algometer/Doloriometer was used to measure the pressure threshold in patients with myofascial trigger points [21]. Inclinator was used to measure the Straight Leg Raise (SLR).

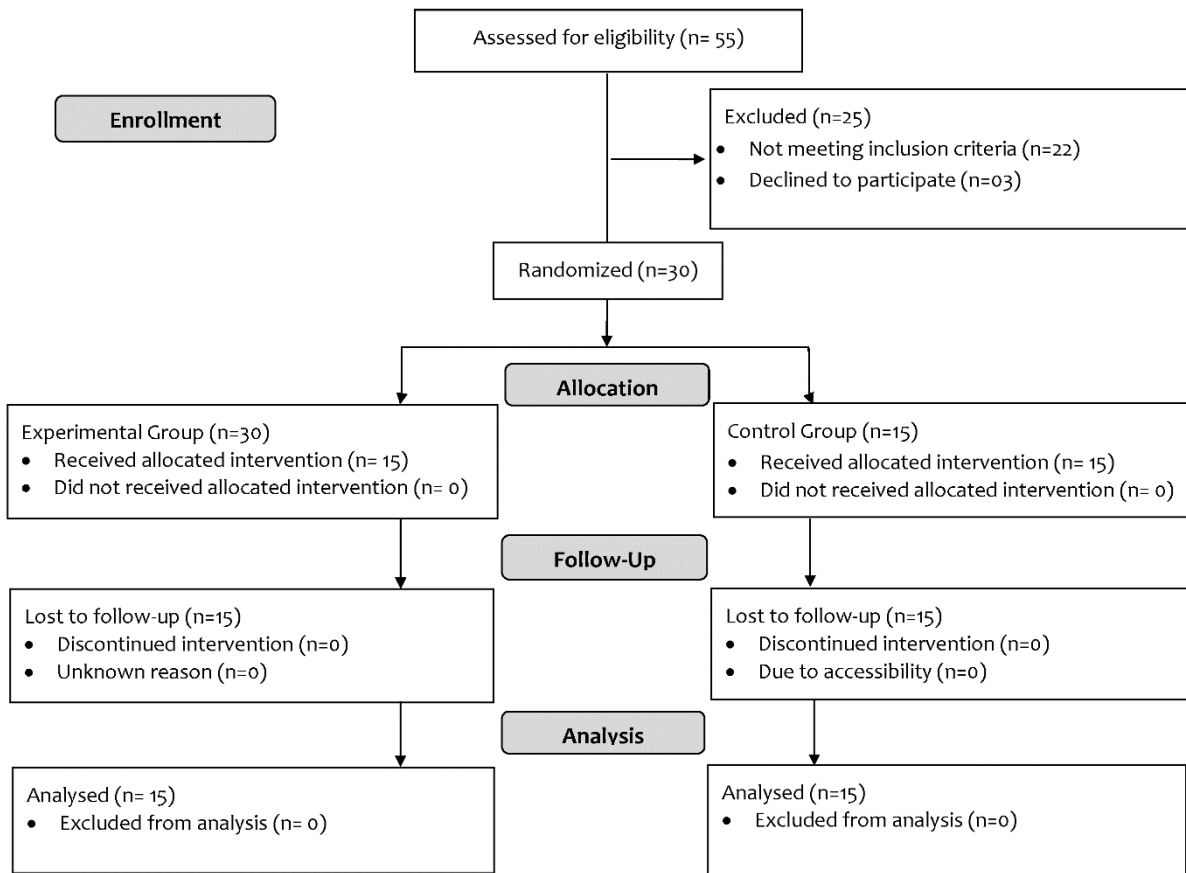


Figure 1: CONSORT diagram

Both groups received a treatment protocol of therapeutic ultrasound and moist hot pack was applied directly over the piriformis muscle for 10mins/1set in prone. The Piriformis muscle stretching for 7sec hold-7reps/1set in supine lying position, Myofascial release of lumbar paraspinal muscles for 3mins/1set in prone lying, gluteal muscles strengthening for 10sec hold-5 reps/1set in sitting as well as standing and sciatic neurodynamic was applied in supine lying position with 10 oscillations/3set. The experimental group additionally received the high velocity low amplitude thrust in downward direction at sacroiliac joint which resulted in popping sound or cavitation. Both treatment protocols were given 3 days per week for 6 weeks.

The results were presented as mean±SD, median, IQR and frequency. The Pain on numeric pain rating scale was not normally distributed so for pre-post analysis Wilcoxon sign rank test and for comparison Mann Whitney U test was applied. While all other variables including SLR, pain pressure threshold and piriformis muscle length was normally distributed, so paired sample test used for pre-post analysis and independent t-test for group comparison. The SPSS ver 22 was used for data analysis while keeping the significance level at $p < 0.05$.

RESULTS

The age range of n=30 participants was from 30-60 years. The mean age of the participants was 40.46 ± 10.51 years. A total of n=22 participants were female and remaining n=8 were male in the study. Majority of the participants were having right piriformis syndrome n=17(56.67%) as compared to left piriformis syndrome n=13(43.33%). A total of n=10(33.3%) were house wives, n=8(26.67%) were doctors, n=8(26.67%) were office workers and remaining n=4(13.33%) were teachers. 13.35% reported that their onset of pain was 3 months before, 20% had 6 months before and 66.65% reported pain from more than a year.

It was observed that pain, SLR, pain pressure threshold and piriformis length was significantly improved ($p < 0.001$) in both the experimental and control group after 6th week intervention. (Table 1) All variables were comparable at the baseline. But the result showed that there is no significant difference between the groups after 6-week intervention regarding the pain, SLR and piriformis muscle length, except pain pressure threshold which was significantly improved in experimental group as compared to control group (67.7 ± 18.42 vs 52.51 ± 15.26 , $p = 0.020$). (Table 2)

Table 1: Pre-Post analysis (Pain, SLR, Pain Threshold and Piriformis muscle length)

		Experimental Group (n=15)			Control Group (n=15)		
		Mean±SD/M(IQR)	MR/MD	p-value	Mean±SD/M(IQR)	MR/MD	p-value
Pain (NPRS)	Pre	6(1)	8	0.00***	6(2)	7.5	0.00***
	Post	2(2)			3(1)		
Straight Leg Raise (inclinometer)	Pre	40.93±9.72	29.11	0.00***	40.86±10.37	32.26	0.00***
	Post	70.04±17.69			73.13±13.60		
Pain Pressure threshold (Algometer)	Pre	40.75±15.89	27.01	0.00***	32.8±13.34	19.63	0.00***
	Post	67.7±18.42			52.51±15.26		
Piriformis length (Digital goniometer)	Pre	49.4±10.22	25.04	0.00***	51.38±12.70	16.73	0.00***
	Post	74.4±9.30			68.12±11.74		

Significance level: $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$

Table 2: Comparison between Experimental and control group (Pain, SLR, Pain Threshold and Piriformis muscle length)

		Experimental Group (n=15)		Control Group (n=15)		p-value
		Mean±SD/M(IQR)	MR/MD	Mean±SD/M(IQR)	MR/MD	
Pain (NPRS)	Pre	6(1)	1.14	6(2)	0.714	
	Post	2(2)		3(1)		5.06
Straight Leg Raise (inclinometer)	Pre	40.93±9.72	0.66	40.86±10.37	0.986	
	Post	70.04±17.69		73.13±13.60		-3.08
Pain Pressure threshold (Algometer)	Pre	40.75±15.89	7.87	32.8±13.34	0.153	
	Post	67.7±18.42		52.51±15.26		15.26
Piriformis length (Digital goniometer)	Pre	49.4±10.22	-1.94	51.38±12.70	0.647	
	Post	74.4±9.30		68.12±11.74		6.36

Significance level: $p < 0.05^*$, $p < 0.01^{**}$, $p < 0.001^{***}$

DISCUSSION

The main objective of this study was to find out the effectiveness of thrust joint manipulation of sacroiliac joint on pain pressure threshold in patients with chronic piriformis syndrome. Both treatments i.e. conventional physical therapy and thrust joint manipulation of sacroiliac joint have shown positive effects on pain intensity, piriformis muscle length and straight leg raise. When between group analysis was done except pain pressure threshold which was significantly improved with sacroiliac joint thrust manipulation.

The results of current study confirmed that high velocity low amplitude thrust manipulation group showed better improvement in term of improving pain pressure threshold for piriformis syndrome patients. A systematic review was conducted to measure the effectiveness of different physical therapy treatments. The study concluded that high velocity low amplitude thrust technique was proved to be more effective as compare to rest of the interventions in managing the pain associated with piriformis syndrome supporting the results of current study [22].

A study at the college of chiropractors in Chicago was carried out where they presented a case with piriformis anomaly resulted into piriformis syndrome and compression of sciatic nerve causing pain down the legs and numbness as well. They treated the related symptoms with high velocity low

amplitude thrust manipulation on sacroiliac joint and this technique have shown significant changes in patient's symptoms i.e. pain intensity was improved on visual analogue scale and overall functional performance as well after treating the patient for 2 weeks on alternative days[23].

In a randomized controlled trial, participants were divided into three groups i.e. group A, B and C and administered with Sacroiliac joint manipulation, lumbar spine manipulation with ischemic compression and ischemic compression alone for 5 days respectively. This study has summarized that over all the three interventions, sacroiliac joint manipulation was proved to be more effectiveness as compare to the remaining treatment options in alleviating pain and improving pain pressure threshold for patients diagnosed with chronic piriformis syndrome [24]. The results of this study strongly support the current study where sacroiliac joint manipulation was proved to be more effective in improving the overall pain.

In the current study, subjects in the experimental group were intervened with conventional physical therapy including stretching exercises too with the addition of sacroiliac joint thrust manipulation technique and this treatment protocol resulted into greater improvement. A study to compare the two physical therapy treatment techniques in postpartum females suffering from symptoms associated with piriformis syndrome to improve pain and pain pressure threshold. The included treatments were manipulation of sacroiliac

joint with ice and stretch with the sacroiliac joint manipulation alone. The study concluded that both interventions are equally effective and has shown significant effects on pain improvement and pressure algometry [25]. This study favours the current study results. Another study compares two physical therapy treatment techniques, cross friction massage and stretching exercise in patients with piriformis syndrome. They reported that cross friction massage is more effective in reducing pain and improving functional abilities in patients with piriformis syndrome as compare to stretching exercises [14].

The results of current study showed that strengthening exercises have effective results in improving hip muscle strength and coordination for both conventional and experimental group. A study to measure the effectiveness of hip muscle strengthening exercises along with conventional physical therapy approach in improving gluteal muscles strength hence improving overall musculoskeletal discomfort and pain associated with chronic piriformis syndrome. The study showed better compliance and effectiveness with strengthening exercises in improving muscle strength, coordination hence reducing weakness and overall musculoskeletal discomfort resulted from piriformis syndrome [26].

In this study, neural mobilization combined with conventional physical therapy showed improvement in reducing pain, improving piriformis length and straight leg raise in patients with chronic piriformis syndrome. According to Mulla AA. neural mobilization and piriformis muscle stretching were more effective in lowering the pain related to sciatic nerve compression beneath the piriformis muscle, improving efficiency of gluteal muscles majorly the piriformis muscle and gait pattern [6]. A study was conducted on patients with Piriformis syndrome to determine the effectiveness of passive mobilization of sciatic nerve versus self-mobilization. They reported that both techniques were effective in reduction of pain and improving hip functions but passive mobilization was more effective in the management of piriformis syndrome compared to the self-mobilization for improving pain and hip functions [27].

The current study reported that myofascial release technique as a part of conventional physical therapy showed improvement in reducing pain, improving piriformis length and functional mobility in patients with chronic piriformis syndrome. A study to compare the effectiveness of myofascial release technique with conventional physical therapy in patients with chronic piriformis syndrome to improve total piriformis muscle length, pain intensity and functional mobility. The results of the study concluded that myofascial release technique

resulted in to restore piriformis muscle length, improving pain intensity and functional outcomes and has significant effects as compare to conventional physical therapy [28]. Another study reported that soft tissue mobilization including myofascial release with the addition of piriformis stretching exercises along with sacroiliac joint manipulation are of better treatment in patients with pain due to piriformis syndrome [29].

The study is limited because most of the participants in the study were females. This gender heterogeneity may be confounding effect on the results. The sensitivity of body because of piriformis muscle trigger point should be differentiated from the pain caused by repetitive placement of Algometer's tip over the targeted area on every step of data collection. Algometer measurements were taken by pressing the tip of the Algometer directly over the area where piriformis muscle stiffness was maximum. This method is just as same the ischemic compression method so outcome measures can have fluctuating results.

CONCLUSION

The conventional physical therapy with and without sacroiliac joint manipulation were equally effective in treating chronic piriformis syndrome to improve the pain intensity, piriformis muscle length and straight leg raise. But addition of sacroiliac joint manipulation may improve pain pressure threshold of the Piriformis muscle. The future studies are recommended with more accurate method to measure the pain pressure threshold should be added in future studies. An equal gender and race distribution in future studies would make it more relevant to the population affected.

Author's Contribution

BS and ST: substantial contributions to the conception and design of the study.

SN and IH: Data Processing, Collection, Perform Experiment.

MAHT and SAH: Analysis and interpretation of data for the study.

AGS: revised it critically for important intellectual content.

BS, ST, SN, IH, MAHT, SAH, AGS and MMK: final approval of the version to be published and agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. All authors contributed to the article and approved the submitted version.

Ethical Statement

The study was conducted at Max Rehab and Physical Therapy Centre G-8 Markaz, Islamabad, Pakistan after the approval from research and ethical committee of faculty of rehabilitation and allied health sciences Riphah International University (REC/00693).

Consent Statement

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

Acknowledgments

Non to declare.

Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

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