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COMPARISON OF DIRECT TREATMENT APPROACH AND INDIRECT TREATMENT APPROACH ON PAIN AND FUNCTION IN PIRIFORMIS SYNDROME WITH SCIATICA

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ABSTRACT

BACKGROUND: Piriformis syndrome involves sciatic nerve compression by piriformis muscle, causing buttock pain, burning sensation due to muscle spasms or inflammation, characteristic symptoms.

AIM: This study aims to compare the effect of direct and indirect treatments on pain and function in piriformis syndrome with sciatica individuals.

METHODOLOGY: After obtaining ethical clearance, 42 participants meeting inclusion criteria were divided into three groups of 14 individuals each. Over four weeks, all underwent five days per week sessions. Group A received Direct treatment, Group B received Indirect treatment, and Group C underwent Conventional therapy. Pre- and post-data were assessed using the Numerical Pain Rating Scale (NPRS), Sciatica Bothersome Index Scale (SBI), and Straight Leg Raise (SLR) to evaluate outcomes.

RESULT: The Shapiro-Wilkinson test assessed data normality, and inferential statistics were applied for group differences using the Kruskal-Walli's test and Bonferroni post hoc test. Intra-group analysis employed the Wilcoxon sign rank test, revealing p-values <0.005 in NPRS, SBI, and SLR for all three groups. Similarly, inter-group comparison indicated p-values <0.005 in NPRS, SBI, and SLR across all three groups.

CONCLUSION: The study revealed that Group A receiving direct treatment exhibited notably superior improvement compared to Groups B (indirect treatment) and C (conventional therapy) in managing piriformis syndrome and sciatica. However, all interventions were equally effective in reducing NPRS, enhancing Sciatica Bothersome Index scale (SBI), and improving functionality through the straight leg raise (SLR) test.

Keywords: Piriformis syndrome, strengthening, stretching, post isometric relaxation

INTRODUCTION

Piriformis syndrome (PS) results from compression of the sciatic nerve beneath the piriformis muscle, typically causing pain, burning sensations, gluteal numbness, and tingling. It can stem from various factors such as muscle spasm, inflammation, hip injuries, muscle hypertrophy due to excessive exercise, or prolonged sitting **[1]**. The syndrome is categorized into primary, accounting for <15% of cases, involving inherent muscle issues or anatomical changes in the sciatic nerve, and secondary, more common, resulting from anomalies like inflammation, hypertrophy, local ischemia, or injuries altering biomechanics **[2]**. Robinson coined the term "Piriformis Syndrome" in 1947, describing it as a relatively uncommon yet severe Nervomuscular condition. Clinical presentation is influenced by both somatic and neuropathic factors, with a myofascial pain condition underlying PS as its somatic component, potentially involving nearby muscles in symptomatology **[3]**.

Piriformis syndrome lacks a clearly identifiable etiological cause, with trauma being a common trigger in approximately half of the cases, albeit rarely dramatic. It is frequently overlooked as a cause of leg and buttock pain and is considered a clinical syndrome characterized by nerve entrapment, specifically the sciatic nerve becoming trapped in the piriformis muscle **[4]**. Common complaints include buttock pain exacerbated by sitting, tenderness over the greater sciatic notch, and discomfort during piriformis muscle exercises, along with restricted hip range of motion, particularly internal rotation **[5]**. Women are three times more susceptible to PS than men, often due to a wider quadriceps femoris muscle angle. Conversely, men may aggravate symptoms by placing a wallet on the affected side when sitting **[6]**.

Around 17% of patients experiencing sciatic-like pain with negative spinal imaging are diagnosed with PS. The pear-shaped piriformis muscle, part of the short external rotator group, originates from the sacrum and sacrotuberous ligament, extending to the greater trochanter, and plays a role in hip external rotation and abduction. Despite its significant function, it is often overlooked due to its proximity to the sciatic nerve **[7]**.

The piriformis muscle functions as a flexor transitioning to an internal rotator during hip flexion exceeding 60 degrees, remaining active during sitting to aid in hip elevation and outward rotation for balance **[8]**. Diagnosis of piriformis syndrome (PS) relies on clinical tests like Lasègue, Freiberg, FAIR, and Beatty, complemented by neurophysiologic exams and radiographic investigations to confirm muscle enlargement. PS occurs from sciatic nerve compression within the infra-piriformis canal, leading to inflammation and leg pain **[9]**. The Beaton and Anson classification system categorizes structural variations, while sciatica, stemming from nerve root compression, presents with lower extremity symptoms, managed acutely with medications and physical activity and chronically with therapies like physical therapy or surgery **[10]**.

Treatment for piriformis syndrome involves a range of non-surgical methods such as pharmacological therapies, therapeutic interventions like stretching and massage, and surgical techniques like sciatic nerve decompression **[11]**. Physiotherapy includes exercises to strengthen hip abductors and stabilize anterior hip flexor muscles like iliopsoas, crucial for hip joint function **[12]**. Post-isometric relaxation (PIR) is used to relax tight muscles, improving joint motion. Stretching aims to enhance joint range of motion and alleviate symptoms by releasing nerve strain. Overall, a comprehensive approach including stretching, strengthening, and therapeutic interventions is essential for managing piriformis syndrome effectively **[13]**.

MATERIALS AND METHODOLOGY

A comparative study was conducted at Prehab Physio & Pilates studio and Parikrama flat in Ahmedabad, utilizing simple random sampling to select 42 subjects. The research aimed to assess the effectiveness of a four-week intervention program, consisting of five days weekly sessions. Subjects, meeting inclusion criteria after ethical clearance (IEOCHR-SAINATH HOSPITAL/AHMC/86), were informed about the research protocol and provided signed consent. Demographic data including age, gender, and occupation were gathered prior to the intervention. Participants with piriformis syndrome and sciatica were divided into three groups

(Group A, B, and C, each with n=14) using the chit method for random allocation.

INCLUSION CRITERIA [15, 16, 19]:• Age: 25-45 • Male and Female both are included •Tenderness at the piriformis insertion graded as level 1 to 3. • Positive FAIR test, active piriformis stretch test, seated piriformis stretch test • Sciatica bothersomeness index scale score more than 3 (somewhat bothersome) in all symptoms

EXCLUSION CRITERIA [14, 16, 18]: • Any congenital or acquired abnormalities in the spine related to disc pathology • Prediagnostic musculoskeletal abnormalities in the hip and lumbar spine • Femoral head avascular necrosis • Hip and lumbar spine osteoporosis • Femur fracture•Hip dislocation • Inflammatory diseases causing discomfort in the hip and sacroiliac joints • Rheumatological disorder • Pregnancy.

Group A: Piriformis Stretch and Strength Treatment Protocol [9, 19, 20, 21]

For 1st week

Table 1: Direact Treatment Approach

Sr. No.	Exercise	Description	Repetition	Hold
1	Piriformis Stretching	The person was on their back then the affected leg's foot is flat on the surface and both knees are bent. The injured leg's ankle was positioned above the unaffected leg's knee. Gripping the limb of the unaffected leg, the person slowly brought it up to their chest until they felt their affected leg's outer hip and buttocks beginning to extend	3	30sec
2	Post isometric Relaxation	The patient in supine lying posture, then the treated leg is flexed at both the knee and hip joint, place the foot on the table to side of opposite knee (crossing the treated leg over the other). To stabilise the pelvis, with one hand on the opposing ASIS and the other against the laterally flexed knee, the therapist applies pressure. The knee is then pushed into resisted abduction, engaging the piriformis muscle. The initial position is determined by the first indication of resistance toward the end range. The therapist's exertion will match the patient resistance, with the some effort being around twenty percentage of the patient strength.	3	5sec
3	Side lying hip abduction	Patient is placed in side lying position, elevate the upper leg toward the ceiling in a gradual motion and then return it to the initial position.	10	10sec

For 2nd week

Sr. No.	Exercise	Repetition	Hold
1	Piriformis Stretching	3	30sec
2	Post isometric Relaxation	3	10sec
3	Side lying Hip abduction with 500gm Weight	10	10sec

For 3rd week

Sr. No.	Exercise	Description	Repetition	Hold
1	Lateral slides with green Thera band	Secure the TheraBand around both ankles. Stand with a slight bend in your knees and hips. Take a step to the side, spanning 6–8 inches, and then bring the other foot along.	15	10sec
2	Piriformis Stretching	Same as above	3	30sec
3	Post Isometric Relaxation		3	10sec
4	Side lying Hip abduction with 1 kg weight.		10	10sec

For 4th week

Sr. No.	Exercise	Repetition	Hold
1	Piriformis stretching	3	30sec
2	Post isometric relaxation	3	10sec
3	Side lying hip abduction with 1kg weight.	10	10sec
4	Lateral slides with Blue Thera band	20	10sec

Group B: Hip flexors Stretch and strength Protocol [5, 10, 22, 23]

For 1st week

Table 2: Indireact Treatment Approach

Sr. No.	Exercise	Description	Repetition	Hold
1	Iliopsoas stretching	The patient's legs are hanging over the table in the decubitus dorsal position. By holding each knee and hip with a separate hand and passively extending the angle of hip that created enough tenseness throughout the muscle, the physiotherapist was able to manoeuvre the patient opposing knee and hip into maximal extension.	3	30sec
2	Post isometric relaxation of iliopsoas	The patient is lying on their back with the buttocks positioned at the table's edge. Not treated leg is completely flexed at both the hip and knee, held in place by the patient. The affected leg is left to hang freely. The therapist's hands are positioned on the front distal part of thigh and front proximal part of the opposite limb. Following an isometric contraction, the thigh is gently moved just beyond the restricted range during exhalation, applying slight pressure toward the floor.	3	10sec

For 2nd week

Sr. No.	Exercise	Description	Set	Repetition	Hold
1	Hip Flexor muscle Training with green Thera band	The patient is standing with a Thera band secured approximately 5cm above the knee joint. They are told to fully extend hip flexion towards exercise side and then revert initial posture.	3	15	No hold
2	Iliopsoas stretching	Same as above	1	3	30sec
3	Post isometric relaxation of iliopsoas		1	3	10sec

For 3rd week

Sr. No.	Exercise	Description	Set	Repetition	Hold
1	Step-up	Elevate your body onto the step, then return to the initial position by stepping backward.	1	15	No hold
2	Iliopsoas stretching	Same as above	1	3	30sec
3	Post isometric relaxation of iliopsoas		1	3	10sec
4	Hip Flexor muscle Training with blue Thera band		3	20	No hold

For 4th week

Sr. No.	Exercise	Description	Set	Repetition	Hold
1	Forward lunges	Extending yourself forward and bringing your front and rear legs close to a 90-degree angle. Then, to get back up to a standing position, press into your front foot and heel.	2	15	5sec
2	Iliopsoas stretching	Same as above	1	3	30sec
3	Post isometric relaxation of iliopsoas		1	3	10sec
4	Hip Flexor muscle Training with blue Thera band		3	25	No hold
5	Step-up		2	15	No hold

Group C: Conventional Treatment [22]

Table 3: Coventional Therapy

Sr. No.	Exercise	Description	Repetition	Hold
1	Single knee to chest	With one knee bent 90 degrees on the ground, the person is laying on their back. Pull one knee toward the chest while sustaining this posture.	10	10sec
2	Double knee to chest	With both knees 90 degrees bent on the ground, the patient is lying on his back. Keep your knees pulled both towards your chest.	10	10sec
3	Clam shell	With their knee bent 90 degrees and their feet together, the patient lay on their side. Position Squeeze your gluteal muscles and bend your knee slowly towards the celling.	10	10sec
4	Bridging	With both knees bent 90 degrees on the ground, the patient lies on their back. Gradually lift your hips towards the celling.	10	10sec

OUTCOME MEASURE [24, 25, 26]

1. Numerical pain rating scale (NPRS): ICC =0.95
2. Sciatica Bothersome index scale (SBI): ICC =0.88
3. Straight leg raises (SLR): ICC = 0.93

RESULTS

Table 5 & 6 show there is Significant normality deviation ($P<0.05$) led to parametric tests. Kruskal-Wallis revealed intergroup disturbance for NPRS-REST &ACTIVITY 'POST' ($P<0.05$), highlighting DTA vs CONVENTIONAL significance ($P<0.05$); Wilcoxon Sign Rank Test showed significant disturbance across all groups (DTA/ITA/CONVENTIONAL), with mean change order:

CONVENTIONAL<ITA<DTA.

Table 7 & 8 show that there is Shapiro-Wilkinson test ($P<0.05$) guided parametric test selection. Intra-group analysis via KRUSKAL WALLIS found significant disturbance in SLR & SBI for 'POST' interval ($P<0.05$). Bonferroni posthoc highlighted DTA vs CONVENTIONAL ($P<0.05$) & DTA vs ITA

significance. Inter-group analysis using Wilcoxon Sign Rank Test showed significant difference (P<0.05) across DTA/ITA/CONVENTIONAL. Mean change (PRE-POST): CONVENTIONAL<ITA<DTA.

Table 4: Mean Age Distribution in all Group

	Group A (DTA)	Group B (ITA)	Group C (Conventional)
MEAN	37.42	39	39.42
SD	4.16	4.34	4.08
KRUSKAL WALLIS P VALUE	0.42		
	DTA vs ITA.	0.58	
	DTA vs CON.	0.42	
	ITA vs CON.	0.96	

Significantly significant P<0.05 led to non-parametric tests due to Shapiro-Wilkinson test indicating normality differences (P<0.05). Kruskal-Walli's test found no significant difference in mean age between groups (P>0.05)

Table 5: Comparison of NPRS-REST

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
DTA		2.57±0.72	0.78±0.67	6.80	0.0001*	1.79±0.69
ITA		2.85±1.05	1.28±0.88	4.28	0.0002*	1.57±0.92
CONVENTIONAL		3.14±0.83	1.59±0.90	4.79	0.0001*	1.55±0.86
P VALUE (KRUSKAL WALLIS TEST)		0.24	0.04*			
P VALUE (Bonferroni) POSTHOC TEST)	DTA vs ITA	0.67	0.25			
	DTA vs CON	0.21	0.03*			
	ITA vs CON	0.65	0.62			

Table 6: Comparison of NPRS-Activity

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
DTA		5.28±1.48	1.85±0.91	7.38	0.0001*	3.43±1.29
ITA		4.78±1.47	2.42±1.11	4.79	0.0001*	2.36±1.28
CONVENTIONAL		5.01±1.08	2.78±0.93	6.37	0.0001*	2.23±0.99
P VALUE (KRUSKAL WALLIS TEST)		0.57	0.04*			
P VALUE (Boneferroni) POSTHOC TEST)	DTA vs ITA	0.59	0.28			
	DTA vs CON	0.98	0.04*			
	ITA vs CON	0.68	0.603			

Table 7: Comparison of SBI

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
DTA		16.07±2.93	8±2.44	7.91	0.0001*	8.07±2.62
ITA		16.64±2.60	10.5±2.12	6.84	0.0001*	6.14±2.41
CONVENTIONAL		15.57±2.47	10.5±1.99	5.98	0.0001*	5.07±2.23
P VALUE (KRUSKAL WALLIS TEST)		0.57	0.005*			
P VALUE (Boneferroni) POSTHOC TEST)	DTA vs ITA	0.83	0.01*			
	DTA vs CON	0.87	0.01*			
	ITA vs CON	0.54	0.99			

Table 8: Comparison of SLR

		PRE	POST	WILCOXON SIGN RANK TEST	P VALUE	DIFFERENCE
DTA		58.07±4.49	69.42±3.71	4.91	0.0001*	11.35±6.12
ITA		57.35±3.93	64.42±3.41	1.93	0.02*	7.07±9.61
CONENTIONAL		58.92±3.29	64.57±3.72	1.75	0.01*	5.65±8.45
P VALUE (KRUSKAL WALLIS TEST)		0.88	0.004*			
P VALUE (Boneferroni) POSTHOC TEST)	DTA vs ITA	0.97	0.001*			
	DTA vs CON	0.87	0.001*			
	ITA vs CON	0.96	0.99			

DISCUSSION

This study aimed to investigate the effects of direct and indirect treatment approaches on pain and functional outcomes in individuals aged 25 to 45 with piriformis syndrome and sciatica. Over four weeks, participants underwent either direct treatment involving piriformis stretch and strength training (Group A) or indirect treatment focusing on hip flexors stretch and strength training (Group B), alongside conventional training. Control group (Group C) received only conventional training. Numeric Pain Rating Scale (NPRS), Sciatica Bothersome Index Scale (SBI), and straight leg raising (SLR) were used as outcome measures. Significant improvements in pain intensity and functional scores were observed across all intervention groups. Participants in Group A and Group B received conventional training concurrently.

Piriformis syndrome, stemming from a tightened muscle, leads to sacral and lower lumbar vertebrae rotation, causing pain in the lower back, thoracic region, and neck. Static stretching enhances muscle elasticity, while Muscle Energy Technique (MET) and Post-Isometric Relaxation (PIR) promote relaxation and joint mobility, addressing muscle tightness and spasms. MET involves voluntary contraction against resistance, while PIR induces muscle lengthening during stretching, reducing the risk of ruptures **[11]**.

Piriformis muscle overloading, often due to weakened hip abductor and extensor muscles, can compress the sciatic nerve. Strengthening these muscles alleviates strain on the piriformis and reduces nerve compression risk. Thera-band resistance exercises effectively enhance muscle strength, mass, and bone density, promoting overall mobility. Krishnendu Laha's 2018 study observed improved pain intensity and lower extremity function scores in individuals with buttock pain associated with piriformis syndrome.

The hip flexor muscles play a crucial role in lower body movement and require

both strengthening and stretching to prevent injuries and enhance functionality. Strengthening these muscles corrects abnormal movement patterns, alleviating strain on the piriformis and reducing sciatic nerve compression. Resistance band training effectively improves muscle strength in hip flexion movements. Concerns about iliopsoas strengthening potentially harming the hip joint should be addressed, as it is essential for overall hip health **[27]**.

CONCLUSION

The study found a notably more significant improvement in Group A, which underwent a Direct treatment approach, compared to Group B with an indirect treatment approach, and Group C receiving conventional therapy. Despite this, all approaches showed equal effectiveness in addressing NPRS, Sciatica Bothersome Index scale (SBI), and straight leg raise (SLR) test, indicating successful symptom reduction and enhanced functionality in individuals with piriformis syndrome and sciatica.

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