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A Study of Prevalence of Piriformis Syndrome in Long Route Bike Riders

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ABSTRACT

Introduction: Piriformis syndrome is a condition caused by prolonged or excessive contraction of piriformis muscle with entrapment of sciatic nerve. In long route motorcycling the rider will sit constantly in the same posture throughout his ride. Prolonged sitting in the same posture can lead to restriction of blood and can cause distress to the body which leads to muscle stiffness and discomfort. This can lead to various musculoskeletal disorders often called as driving related musculoskeletal disorders.

Methodology: Ethical clearance was obtained from Institution Ethical Committee. Total 205 participants were included in this study according to the inclusive criteria; Participants were diagnosed through two test Modified FAIR test and Sitting piriformis stretch test. The intensity of pain was rated through Numeric Pain Rating Scale.

Result: A total of 205 long-route bike riders participated in the study. Among them, 108 individuals tested positive for the piriformis test, indicating a prevalence rate of 52%.

Conclusion: This study identified a 52% prevalence of piriformis syndrome among long-route bike riders. Further analysis showed that affected riders covered a mean riding distance of 800 km, suggesting that prolonged riding duration contributes to the development of piriformis syndrome.

Keywords: *Piriformis Syndrome, Long Route bike Riders, Modified FAIR test, Seated Reach Test*

1. INTRODUCTION

Piriformis syndrome is a condition caused by prolonged or excessive contraction of piriformis muscle with entrapment of sciatic nerve. It is characterized by pain in buttocks hip and lower limb. In 1928 yeoman was the first to describe pain in the region supplied by the sciatic nerve in piriformis syndrome. Piriformis syndrome is considered as 5-6 % cause of sciatica. The incidence of piriformis syndrome is 2.4 million per year occurring most commonly in middle aged patient. Piriformis syndrome is the key landmark to all important nerves and vessels that pass from gluteal region and it is considered as the only muscle that courses transversely through greater sciatic notch [1].

Piriformis muscle is the most superficial muscle among the deep gluteal muscle, it is a part of lateral rotators of hip joint. It originates from anterior aspect of sacrum at level of about S2 through S4 and inserts to the superior and medial aspect of greater trochanter. The muscle leaves the pelvis until it attaches to superior margin of greater trochanter through greater sciatic notch. Piriformis muscle is usually supplied by first and second sacral nerves [2]. The two components which

contributes to the clinical presentation are somatic and neuropathic. The somatic component is a myofascial pain syndrome of piriformis syndrome. The neuropathic component refers to irritation and compression of the sciatic nerve as it passes from infra-piriform foramen [3] .

There are number of factors which leads to piriformis syndrome such as: - Gluteal trauma in sacroiliac area, Hypertrophy of piriformis muscle, Myofascial trigger points, Predisposing anatomic variants, Bursitis of piriformis muscle [1] . Piriformis syndrome is most commonly remained misdiagnosed due to various differential diagnosis of piriformis syndrome such as: - Herniated intervertebral disc [4], painful vascular compression syndrome of the sciatic nerve [5], and inflammation of sacroiliac joint [6]. There are 3 specific condition which contribute to piriformis syndrome: i) Myofascial referred pain from trigger points in piriformis muscle, ii) Entrapment of the adjacent muscle, nerve and vessel by the piriformis muscle at the greater sciatic foramen and iii) Sacroiliac joint dysfunction [7] . In 97.9% cases gluteal pain is most commonly observed, in 81.9% cases pain and paraesthesia in groin, back, buttock, perineum, back of thigh is observed and in 18.1% cases are associated with low back pain. 35 – 95% patient with piriformis syndrome suffer intense pain when they sit or squat [8,9] .

There is various test which are used for assessing and diagnosing piriformis syndrome. modified FAIR test is commonly used for diagnosing piriformis syndrome. Flexion adduction internal rotation test (FAIR) stretches the piriformis muscle that compresses the sciatic nerve which leads to pain in the sciatic/gluteal region. The sensitivity of FAIR test is 88% and specificity is 83%. seated piriformis stretch test is another test used for diagnosing piriformis syndrome. this test is performed in sitting and it lengthen the deep rotators of hip joint and create dural tension of sciatic nerve to elicit gluteal pain[10] **.** The seated piriformis stretch test has sensitivity of 52% and specificity of 90% [11].

Piriformis syndrome can be treated by conservative treatment, physiotherapy, life style modification, and pharmacological agents. In rare cases surgical intervention are done. Local anaesthetic injection, steroids and botulinum toxin administered into the piriformis muscle can serve as both diagnostic and therapeutic purpose. Ultrasound guided injection is the recently advanced treatment for piriformis syndrome [12].

The biomechanics of piriformis muscle include its movement as external rotators, weak abductors and weak flexors of hip, which provide postural stability during walking and standing. It acts as external rotator when the hip is flexed 60^{o} or less whereas when the hip is flexed greater than 60^{0} it works as an internal rotator. According to a study weak muscle due to prolong sitting along with poor body posture can lead to piriformis syndrome [13] .

Piriformis muscle is considered as a postural muscle and has a greater tendency to become overactive, weak and hypertonic. Weak gluteal muscle causes hypertonicity and over activation of piriformis muscle which leads to piriformis syndrome. Gluteal maximus and piriformis muscle is considered as the core muscle so when gluteal maximus gets weak, piriformis replaces the function of the gluteal muscle [14] .

Motorcycle is the most common mode of transportation used in India. Long route motorcycling is one of the growing passions in the Indian youngster. In long route motorcycling the rider will sit constantly in the same posture throughout his ride. prolonged sitting in the same posture can lead to restriction of blood and can cause distress to the body which leads to muscle stiffness and discomfort. This can lead to various musculoskeletal disorders often called as driving related musculoskeletal disorders. The most common musculoskeletal disorder faced by the bike riders is low back pain having prevalence of 83% [13] .

Piriformis muscle is considered as the core muscle which can get weakened, hypertonicity indirectly due to gluteus maximus muscle. Gluteal muscle weakens due to prolonged sitting in a specific posture, as in long route bike riders they have to maintain the sited posture for a prolong period of time due to which their gluteus maximus and piriformis muscle can get weakened or hypertonic which can cause to piriformis syndrome.

There is high prevalence of low back pain in long route bike riders but there is very scanty knowledge about piriformis syndrome in long route bike riders, Hence, the above study was conducted to find out the prevalence of piriformis syndrome in long route bike riders

2. MATERIALS AND METHODS

The study was conducted at Dr. D.Y Patil College of Physiotherapy, Kolhapur, for a period of 18 months after receiving the ethical clearance from the Institutional Ethical Committee. The sample size taken for the study was 196 participants based on the inclusion and exclusion criteria.

Inclusion criteria

Male long route bike riders covering more than 500 km in one ride belonging to the 25-45-year age group.

Exclusion criteria

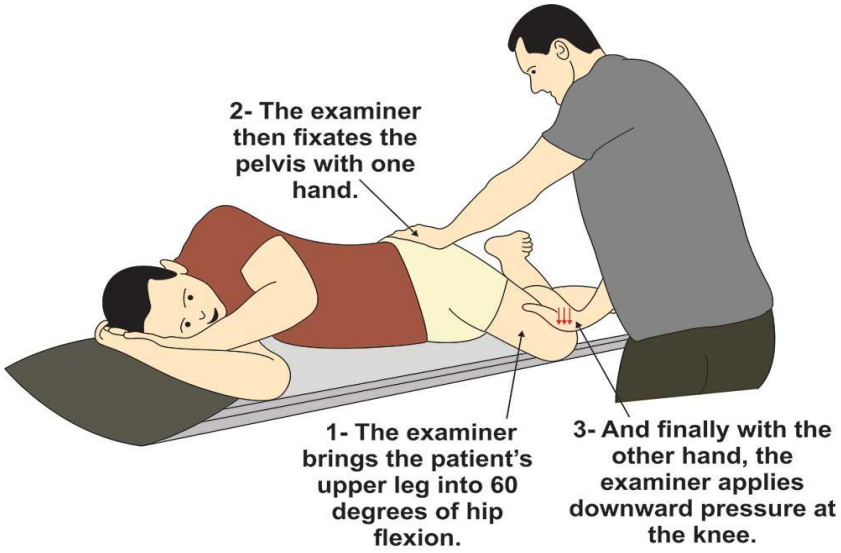
Participants with fracture of lower limb and upper limb, undergone recent surgeries, having recent Trauma to trunk or lower extremity.

Prior written consent form from the participants was obtained. Data collection sheet was recorded before starting the study. A systemic evaluation of musculoskeletal system was carried out. The patient was explained in detail about the test and the signs which he may feel during the test. The patient may have symptoms of low back pain and pain at gluteal region which may elevate during the test. The piriformis syndrome was diagnosed through two test i) Modified FAIR test and ii) Sitting piriformis stretch test.

3. MODIFIED FAIR TEST

Sciatic nerve pain can occur due to several factors which include: - disc herniation, dysfunction of sacroiliac joint, degenerative joint disease, a tight piriformis and more. If the examiner was suspecting to have neural symptoms originating from piriformis tightness, then FAIR test was used to strengthen the hypothesis. The piriformis originates at the ventral surface of sacrum and runs through greater sciatic foramen to insert at superior part of greater trochanter which leads to actions of hip external rotation, abduction and slight extension. the position of flexion, adduction and internal rotation which leads to piriformis stretch and compression of sciatic nerve [15] .

Instructed the patient to lie down inside lying position with tested side on top. Examiner then passively took the tested leg into 90 flexion, adduction and internal rotation, examiner stabilized the hip with one hand and with other hand applied downward pressure to knee which lead to further internal rotation and adduction of hip. This position stretches the piriformis muscle and compresses the sciatic nerve. A positive test occured when pain was produced in the sciatic/gluteal region. Examiner asked the patient exactly where he was feeling pain as pain can be produced in the anterior thigh as well, as a result of femoral acetabular impingement [16] .



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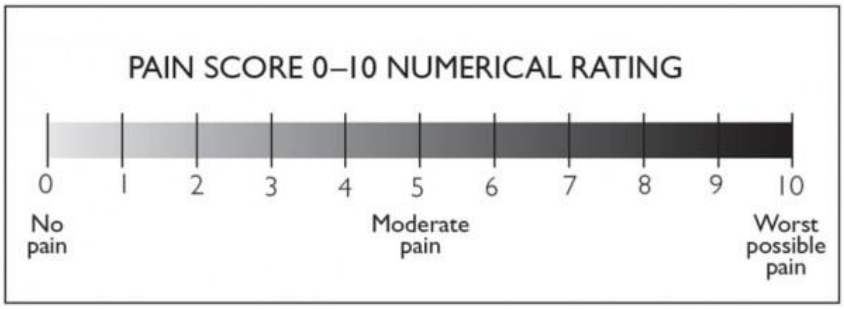
4. SEATED PIRIFORMIS STRECTH TEST

This test was performed in sitting position over the edge of the examination table with hip flexed to 90° flexion and feet resting on the floor. The tested leg was crossed over the non-tested leg and placing the tested leg ankle on the non-tested knee. One hand of examiner was at the tested leg to stabilize while other hand is placed over the lateral side of knee. The patient was then instructed to bend forward so that stretch was applied over the gluteal region. A positive test indicate pain in gluteal region. [11]

Data collected on all the study variables was presented in Ms excel to prepare a master sheet of study. All quantitative variables were expressed in terms of Mean ± sd. All categories' variables were presented in the form of frequency and percentage. Prevalence of piriformis syndrome in long route bike riders was estimated by using following formula.

$$\text{Prevalence} = \frac{\text{Number of long route bike riders having piriformis syndrome}}{\text{Total No. of Bike riders under Study}} \text{ x } 100$$

All the statistical analysis mentioned above was performed by using Ms excel 2016.



Numeric pain rating scale

5. RESULT

Table No. 1 Mean of experience and age of the participants

	Experience	Age
Positive	12.64	38.8
Negative	4.87	29.67

The mean age of the Positive participants was 38.8 years and mean of Experience for the same participants were 12.64 years. The mean age of the negative participants was 29.6 years and the mean experience was 4.87 years.

Table No. 2 Mean of distance covered

	Mean
Positive	1168.51
Negative	997.42

The mean of Distance covered by the positive participant was 1168.51km and by the negative participants was 997.42 km.

Table No. 3 Participants positive for seated piriformis stretch test

Seated Piriformis Stretch Test	No. of Patients (n)	Percentage (%)
Positive	108	52.68%
Negative	97	47.32%
Total	205	100.00%

Total 205 participants were assessed out of which 108 (52.68%) participants were positive for seated piriformis stretch test rest 97 (47.32%) were negative for the test.

Table No. 4 Participants positive for modified fair test

Modified FAIR Test	No of Patients (n)	Percentage (%)
Positive	108	52.68%
Negative	97	47.32%
Total	205	100.00%

Total 205 participants were assessed out of which 108(52.68%) participants were positive for Modified FAIR test rest 97 (47.32%) were negative for the test.

Table No. 5 Pain rating score for the positive participants

Positive Patients			
NPRS	**Mean**	**S.D.**	**P-value**
Rest	2.90	0.84	1.528E-77*
Movement	7.52	0.87	

(* indicates p-value (<0.05) is significant)

The pain score at rest was 2.90 with standard deviation of 0.84 and at movement was 7.52 with standard deviation of 0.87 with a p value of 1.528E-77*

6. DISCUSSION

Piriformis Syndrome (PS) is a neuromuscular condition where the piriformis muscle, located deep in the gluteal region, irritates or compresses the sciatic nerve, resulting in pain, tingling, or numbness along the path of the sciatic nerve, which extends down the leg. This condition mimics the symptoms of sciatica, and it can cause significant discomfort, especially in athletes who engage in activities that involve repetitive motions and prolonged sitting. Among these athletes, long-route riders are particularly vulnerable to developing piriformis syndrome due to the nature of their activities. Bike riding, especially over long distances, requires prolonged periods of sitting in a fixed posture, which can place significant strain on the pelvis, hips, and gluteal muscles, including the piriformis.

The prevalence of piriformis syndrome among long-route bike riders remains difficult to quantify, as there is limited direct research focusing specifically on this population. However, various studies have pointed to a various risk factor which are associated with the long route bike riders. For example, a study by Ida Kartini Othman, Norazlin Mohamad on Risk factors associated with piriformis syndrome states that the risk factors for having piriformis syndrome is Increased age with majority age group between 30 to 50 years, indirect trauma due to prolonged sitting on rigid surfaces and work-related to prolonged sitting (4-6 hours a day), driving (more than 2 hours). It also states that repeated forward movements and lateral movement of the legs, exhibited a compensatory contraction of weak hip abduction and tight adduction were observed, leading to excessive strain to the piriformis muscle, subsequent piriformis muscle shortening. A hypertrophy of piriformis muscles caused by strain is a typical feature of PS, resulting from reduced muscle control, stability in the lumbopelvic, and hip complexity [17] .

Another study conducted by G A Anoop, S A Binoosh on Study on Musculoskeletal disorders among Two- Wheeler Riders of Kerala state in India concluded that the mean age of the riders to get musculoskeletal disorders was 28.15 with a standard

deviation of 5.95 years and the study also showed corelation between the experience of riding and musculoskeletal disorders. The mean experience for riding which can cause musculoskeletal disorders is 7.42 years with a standard deviation of 4.21 years [12].

Previous study conducted by Samraiz Mughal and Mansoor Ahmad on prevalence of piriformis tightness due to long hours sitting among bankers of Faisalabad city. In this study a total 190 participants were assessed among which 65% participants were positive for piriformis test. This study states that piriformis syndrome can occur due to the weak muscle caused due to long sitting. Since we spend most of the time in sitting irrespective of the walking and standing which leads to weakness of Gluteal muscle and hypertonicity of piriformis syndrome which causes piriformis syndrome. This study also indicated that gluteal muscle is the most neglected muscle and so when it gets fatigued, piriformis replaces the gluteal muscle. Due to the continuous functioning of the piriformis muscle, it also gets fatigued after some time and impinges the sciatic nerve passing beneath it causing the piriformis syndrome [13].

Previous study conducted by Ida Ayu Harnum Febry Wiguna on the relationship between sitting duration and piriformis syndrome in handcrafters concluded that when the piriformis muscle is overused in a constant or continuous time, muscle inflammation causes muscle tightness. In addition, the increase in internal-external rotation and prolonged hip adduction causes weakness of the gluteus muscle and results in excessive activation of muscle synergy in the piriformis muscle, which further causes muscle inflammation, which leads to muscle tightness, which causes muscle spasms. Spasm that occurs in the piriformis muscle can compress the sciatic nerve and then cause impaired blood flow or supply to the muscles and nerves, causing pain stimulation from the piriformis muscle area to radiate to the leg, namely the sciatic nerve branching area and tingling radiating from the buttocks to the lower leg and causing clinical symptoms in the form of thickness, numbness, pain in the muscles, and tingling in the sciatic nerve branching area. If the situation is left for years, it can cause piriformis syndrome. Handcrafters of serati banten who sit for ≥5 hours experience more piriformis syndrome than serati banten who sit for <5 hours. As the duration of sitting increases, so does the risk of developing piriformis syndrome and other musculoskeletal disorders [18].

Long-route bike riders often engage in extended cycling sessions that last for several hours, sometimes even days. These extended periods of cycling put immense strain on the body, especially on the lower back, hips, and pelvis. The piriformis muscle, responsible for stabilizing the hip and assisting in the rotation of the thigh, is significantly affected during long-duration rides. Constantly engaging the muscles in a fixed position without adequate rest or stretching can lead to muscle tightness, inflammation, and eventual compression of the sciatic nerve. This creates the perfect environment for the development of piriformis syndrome.

Riding involves maintaining a relatively fixed body posture for prolonged periods. The seated position on a bike, particularly on long-distance rides, often involves leaning forward and applying force to the pedals. In this fixed position, the hips and pelvis are frequently in a flexed state, leading to overuse of certain muscles, including the piriformis. The sustained contraction of these muscles, combined with a lack of movement and mobility, can cause muscle imbalances and tightness. The lack of dynamic movement, which is a crucial part of maintaining muscle health, exacerbates the risk of piriformis syndrome.

One of the key contributors to piriformis syndrome in bike riders is the development of muscle weakness and imbalances. Long-duration cycling primarily uses the quadriceps, hamstrings, and gluteal muscles. However, the piriformis, being a stabilizing muscle, may not be adequately activated or strengthened, leading to weaknesses in the muscle and its ability to support the pelvis properly. This muscle weakness can cause compensatory overuse of other muscles, leading to a tightening of the piriformis, which then compresses the sciatic nerve.

Furthermore, muscle imbalances between the hip flexors and glutes, common in riders due to the forward-leaning posture, can exacerbate tension in the piriformis muscle. Tight hip flexors pull the pelvis into an anterior tilt, which further stresses the piriformis muscle. Over time, this can lead to muscle strain and the development of piriformis syndrome.

The experience of long-route bike riders with regard to piriformis syndrome varies widely, depending on their level of expertise, riding posture, and training habits. Novice riders, or those who are new to long-distance riding, are more likely to experience musculoskeletal issues such as piriformis syndrome. This is due to the lack of proper conditioning and awareness of the importance of maintaining flexibility and strength in the muscles involved in riding.

Piriformis syndrome is a prevalent condition among long-route bike riders due to factors such as long-duration riding, the fixed body position during riding, and muscle weakness. While more experienced riders may be aware of the risks and take preventive actions, novice riders are especially vulnerable. To mitigate the risk of developing piriformis syndrome, riders should focus on maintaining proper posture, incorporating strength training for the glutes and hips, and taking regular breaks to stretch and move. Proper bike fitting and the use of well-designed saddles can also play a crucial role in reducing the strain on the pelvis and preventing the compression of the piriformis muscle. By taking these precautions, riders can continue to enjoy long rides while minimizing the risk of injury and discomfort.

7. CONCLUSION

The above study identified a 52% prevalence of piriformis syndrome among long-route bike riders, with 108 out of 205 participants testing positive for the piriformis test. Further analysis showed that affected riders covered a mean riding distance of 800 km, suggesting that prolonged riding duration contributes to the development of piriformis syndrome. Additionally, the mean age of riders who tested positive was 32 years, and they had an average riding experience of 8 years, indicating that even experienced riders are prone to developing this condition over time. This suggests that cumulative strain on the piriformis muscle from years of riding may be a contributing factor.

Several factors, including prolonged sitting on a bike saddle, poor posture, inadequate stretching, and muscle fatigue, may contribute to the high prevalence of piriformis syndrome in long-route bike riders. The continuous compression and repetitive movement of the piriformis muscle during continuous sitting could lead to muscle tightness and sciatic nerve irritation, resulting in pain and discomfort.

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