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REVIEW ARTICLE

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Gluteal Muscle Weakness and Piriformis Syndrome Relationship

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ABSTRACT

In this short review, we aim to provide the relationship between gluteal muscle weakness and piriformis syndrome, an underdiagnosed cause of buttock and leg pain that mimics pyriformis syndrome can be of gluteal muscle weakness origin. This can be difficult to treat. Based on existing evidence, the present study discussed the available literature on the relation between pyriformis syndrome and its treatment as gluteal muscle strengthening. Source was literature search of the MEDLINE, Scopus and PubMed database from recent years using the search terms e.g., ''piriformis injection', ''gluteal muscle' and ''gluteal muscle weakness. There was no restriction on language. Different structures relevant in this review suggested that there is negative impression of gluteal muscle strength on pyriformis syndrome and adopting gluteal muscle strengthening program in pyriformis syndrome will reduce pain and discomfort in patients in pyriformis syndrome symptoms.

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Introduction

Pyriformis muscle arises along the anterior border of the sacrum (by way of fleshy digitations from the second, third, and fourth sacral vertebrae) and capsule of the sacroiliac joint. It then runs laterally, passing through the greater sciatic foramen, converging into a tendonous insertion (often by the conjoint piriformis and obturator internus or gemelli conjoint tendon) on the upper border of greater trochanter of the femur (through the sciatic notch). Pyriformis muscle is innervated by the first and second sacral nerves.

Pyriformis muscle plays a pivotal role in the movement of lower body stabilization, balance, weight shifting of the body and normal gait. Overall, it takes part in all the ranges of the hip joint and leg movements. it acts as external rotator in the erect position and as abductor in the supine. Studies also suggest that pyriformis muscle is a weak hip flexor during walking.

Pyriformis syndrome known to be a peripheral neuritis that is caused by either hypertrophy, inflammation, or anatomical variation of piriformis muscle resulting strangulated and irritated of sciatic nerve. Further primary piriformis syndrome is related to the anatomical location of piriformis muscle and sciatic nerve whereas secondary piriformis syndrome is caused by repetitive microtrauma, macrotrauma, local ischemia. Symptoms reported in pyriformis syndrome are pain in the gluteus, generally radiates to the lower limbs, may experience paresthesia, hyperesthesia, and muscle weakness. Being most common in women's and athletes is most difficult to diagnose. Women are more prevalent may be due hormonal changes during pregnancy, to anatomical angle of the quadriceps femoris muscle in the women pelvis is wider than men. Other reasons for pyriformis syndrome in common can include Microtrauma in the buttocks may induce inflammation of the soft tissue which results in nerve compression, BMI and history of exposure to long sitting duration, frequency of physical activity (running or walking) or such occupation, and history of back pain. It can also be due to muscle tightness and so compression of sciatic nerve. Other probable factors causing pyriformis syndrome could be pathologies like myositis ossificans or myo-facial, trauma and sometimes total hip replacement.

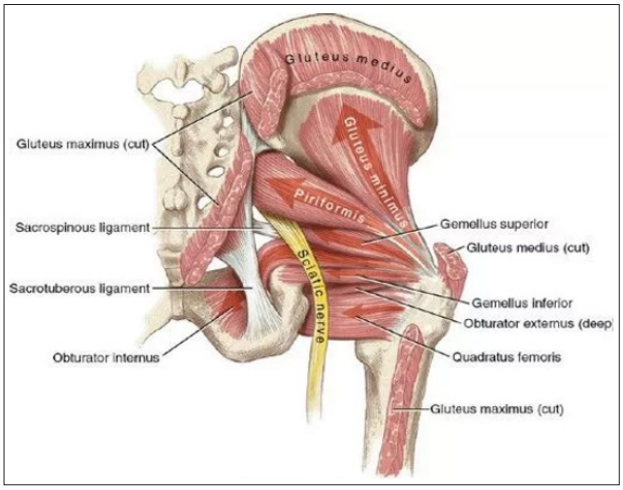

Figure 1: Anatomical position of piriformis muscle and gluteal muscles, A) Gluteus maximus B) Gluteal Medius C) Gluteus minimus

Buttock muscles or gluteal muscle is a group or muscles that is located at the back of the pelvic girdle region above femur. The three muscle that make up the group are gluteus maximus, gluteus Medius, and gluteus minimums.

Gluteus maximus muscle is said to be the strongest and longest muscle in the normal functioning human accounting approx. 16% of the total cross sectional are of that region. Traditionally demonstrated to be origination from the posterior quarter of the iliac crest, the posterior surface of the sacrum and coccyx, and to

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the fascia of the lumbar spine. Studies also suggest it originates from the gluteus Medius fascia, ilium, thoracolumbar fascia, erector spinae aponeurosis, dorsal sacroiliac and Sacro tuberous ligaments, attachments at the sacrum and coccyx. The muscle then runs inferiorly and laterally, splitting into two portions, with the superior portion inserting into the iliotibial tract of the fascia-lata and the inferior portion inserting at the gluteal tuberosity of the femur. Its superior fibers contribute in hip abduction torque and inferior fibers to hip adduction torque [1].

Gluteal maximus acts as try planar stabilizer in functioning through eccentric and or isometric actions to control the available ranges in all 3 planes. Gluteal maximus muscle plays important role as in maintaining of muscle posture, stability of certain joints, in activities of daily living and also in displaying of explosive performance in athletes [2]. It can prevent adduction and internal rotation of the femur. It also acts as local and global stabilizer and mobilizer. The local stabilization takes place in segmental and coordinated way with erector spine, thoraco-lumbar fascia, sacroiliac joint psoas major muscle respectively. With other gluteal muscle it also stabilize the hip by counteracting gravity's hip adduction torque and maintain proper leg alignment by eccentrically controlling adduction and internal rotation of the thigh. It plays a major role in contribution to hip extension and external rotation of the femur.

Gluteus Medius is a broad, thick radiating muscle on the outer surface of the pelvis and between the iliac crest and the gluteal line [3]. It is s inserted into the oblique ridge on the lateral surface of the greater trochanter, with a bursa separating the tendon from the surface of the trochanter. This muscle is a strong abductor and medial rotator of the thigh. Gluteal Medius also plays role in preventing the sagging of the pelvis on the unsupported side during stance phase. Therefor this muscle in one of the main pelvic stabilizer and controller of transvers and frontal plan motion of the femur and hip.

Gluteus minimus muscle is a fan shaped, arising from the outer surface of the ilium, and its fibers converge into a tendon that inserts at the anterior border of the greater trochanter. This muscle action is almost similar to the gluteal Medius muscle [4].

Gluteal muscle strength is most commonly assessed by manual muscle testing and or hand-held dynamometer. The gluteal maximus muscle position is in prone hip extension task with 900 knee flexion to minimize the hamstring muscle force and prevent active insufficiency.

Weaker muscles are limited to their performance or capacities to produce required force in functional situations. This is assumed to result in dominance of synergist muscle group that is adductor magnus and hamstrings in hip extension, biceps femoris and local hip external rotators, in external rotation muscle. Other method includes isometric or isokinetic assessment. A short lever bridge, performed either isometrically (timed) or dynamically (number of repetitions) can also be taken for testing endurance capacity. Inability to maintain the limb control by hip adduction and internal rotation can also be suggestive prediction of gluteal muscles weakness. It is also suggested for pure glutes maximus assessment cause of weakness from neurological, or musculoskeletal impact should be ruled priorly.

Due to gluteal muscle participation in daily activities, it is also susceptible to various micro wear and tear injuries to high impact injuries, its prone for weakness and inhibition. This can negatively impact humans' quality of life. Weakness of gluteal muscle is implicated in various injuries such as low back pain, knee pain, hamstring strain, ankle sprain, impingement syndrome, pyriformis syndrome etc. though all are widely studied there is very less data on weakness of gluteus muscle and its relationship with pyriformis syndrome recorded.

Studies have stated that primary pyriformis syndrome is due to internal intrinsic piriformis muscle problems were secondary pyriformis syndrome can be due to different origin that leads to irritation of pyriformis muscle secondary to sacroiliac joint. Gluteal muscle is also in close anatomical region that can be one of the many reason that can play role influencing the pyriformis syndrome as stated above. There for the present study was undertaken with an objective to discuss the relation of gluteal muscle weakness and its impact in pyriformis syndrome. The present study aim is to find the relation for gluteal muscle weakness in pyriformis syndrome based on the available literature.

Study Procedure

The present study is a short review on the relationship between gluteal muscle and pyriformis syndrome. Different available revies of articles were searched on the MEDLINE, Scopus and PubMed database from recent years using the search terms e.g., ''piriformis injection', ''gluteal muscle' and ''gluteal muscle weakness. There was no restriction on language. Articles that explained and confirmed the relation between the gluteal muscle and pyriformis syndrome were selected. On the basis of five articles further discussion was put forth.

Discussion

As reported Piriformis syndrome is a neuromuscular disorder that occurs tingling and numbness in the buttocks along the path of the sciatic nerve descending down the lower thigh and into the leg in otherwards is the symptoms /irritation of compressed sciatic nerve by the piriformis muscle.

It is very difficult to diagnose pyriformis syndrome as it sometimes confused and mimic with sciatica of lumbar irritation symptoms. There for it is very important to rule out its Couse of origin. Lumbar origin may be from disc pathology, protrusion and or compresses of the sciatic nerve roots, piriformis syndrome is the compression of the nerve due to a tight piriformis muscle. A study stating various factors that can lead to pyriformis syndrome also mentioned atrophy of gluteal muscle can be one of the reasons. Yet there is very less literature in gluteal muscle relation and pyriformis syndrome. Therefore the present study discussed in short review on relation between piriformis syndrome and week glutes muscle. The present study aimed to discuss glutes muscle weakness and pyriformis syndrome relationship in the available literature.

Another study demonstrated gluteal atrophy among the cardinal criteria of the pyriformis syndrome confirmed by different sign sand symptoms. There will be buttock pain with or without radiation the ipsilateral posterior thigh that sometimes extends below the knee to the calf, difficulty in s hip adduction and internal rotation, intolerant sitting, positive Trendelenburg sign and compression of the gluteal nerves is also possible. Motor weakness of the S1 innervated muscles also has been reported as the leading cause of gluteal muscle atrophy in pyriformis syndrome patients. Weakness that may lead to footdrop has also been observed [5].

In a study done on assessment of pyriformis syndrome demonstrated that long standing condition could compromise the muscles supplied by gluteal nerve that is gluteus maximus muscle. This muscle has demonstrated signs of denervation in long standing pyriformis syndrome. Different nerve conduction

studies demonstrate compromised inferior gluteal nerve and the tibial and peroneal divisions of the sciatic nerve [6].

A study suggested that Gluteus Medius weakness may lead to consequential loss of dynamic lateral stability of the pelvis and lead to increased lateral trunk flexion, subsequently altered movement patterns which may contribute to negative impact on pyriformis muscle or in pyriformis syndrome management [7].

A study on electromyographic activity of piriformis syndrome during hip movements concluded that the activity was highest during prone hip extension in external rotation. that showed that piriformis has a role in influencing the role of gluteal muscles and wise versa. There for improvement in gluteal muscles strength and improvement in lateral rotation was seen beneficial in treatment of pyriformis syndrome [8].

Studies have admitted that hip abductor weakness as important finding in management of pyriformis syndrome. Studies have proved that there was strength assessment done of the patient with piriformis syndrome and found weakness in hip abductors and lateral rotators. Specially Weakness of the gluteal muscles has been found leading Couse to development abnormal patterns of movement at the hip joint that can evidently lead to excessive lengthening or eccentric loading on the piriformis during functional activities. Hence weakness of these muscles plays negative role if not managed in pyriformis syndrome [9].

Different studies interventions showed significant improvement in the patient after strengthening the gluteal muscles. Studies targeted to gluteal strengthening program have shown more effective in reducing pain in individuals with piriformis syndromes as compared to conventional isometrics and therefore, gluteal muscle strengthening should be considered as part of treatment in patients with piriformis syndrome.

Conclusion

In the present study five articles were finalized for the discussion on the relationship between gluteal muscle weakness and pyriformis syndrome. Before that anatomical position and function of pyriformis muscle and gluteal muscle group muscle and its functions were understood. Based on available will play a beneficial role in management of pyriformis syndrome management. Future studies have a scope of studying differentiation in age related gluteal weakness and piriformis syndrome in sedentary population versus active population.

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