Section A -Research paper

THE RELATIONSHIP BETWEEN THE HIP MUSCLES' FUNCTIONAL STRUCTURE AND YOGIC POSESNARRATIVE ANALYSIS

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Abstract
The hip joint's functioning and stability, which are essential for daily activities and athletic performance, are greatly influenced by the hip muscles. Yoga has become more well-liked as an adjunct treatment for musculoskeletal issues, such as hip joint stiffness. Through narrative analysis of scientific medical research, this review paper seeks to investigate the connection between hip muscle function and yogic postures. The review will look at the anatomical and functional characteristics of the hip muscles, how yoga affects the strength, flexibility, and motor control of the hip muscles, as well as the biomechanics of a few different yoga poses. The review also emphasises the advantages of incorporating yoga into the treatment of hip joint conditions. According to the narrative analysis, yoga can improve hip muscle function and encourage ideal hip joint mechanics, which will increase hip joint stability and lower the chance of injury. In conclusion, preserving general hip health and avoiding injuries are greatly aided by the functional anatomy of the hip muscles. It has been discovered that yoga poses are useful for enhancing hip muscle function, including range of motion, muscular activation, balance, and stability. Yoga has several benefits, including being low-impact, combining mindfulness and relaxation techniques, and being adaptive to individual needs and skills, even though it may not be as successful as other approaches in addressing specific illnesses like low back pain. Research on yoga's possible effects on hip muscle function and general hip health should continue in the future.

KEYWORDS: hip muscles, functional structure, yogic poses, biomechanics, balance, flexibility, pain, rehabilitation, exercise therapy, yoga, clinical outcomes.

Introduction

The hip joint is a complicated joint that is essential for everyday motions like walking, jogging, and squatting as well as for sports like weightlifting, basketball, and soccer [1]. The femur, the acetabulum, and the surrounding muscles, tendons, and ligaments make up the hip joint. Hip flexors and extensors and hip abductors and adductors are two sets of muscles that

surround the hip joint. Together, these muscles regulate the stability and movement of the hip joint [2].

People of various ages and levels of physical activity can be affected by hip joint dysfunction, a common musculoskeletal problem [3]. Numerous things, such as traumatic injury, repetitive stress, and degenerative changes, can lead to hip joint dysfunction. Pain, a restricted range of motion, and decreased functional capacity can result from hip joint dysfunction [4].

Yoga has gained popularity as an adjunctive treatment for musculoskeletal issues, such as hip joint dysfunction [5]. In order to improve physical, mental, and emotional well-being, yoga is a mind-body discipline that integrates physical postures, breathing exercises, and meditation techniques [6]. Yoga has been demonstrated to increase pain-relieving abilities, as well as muscle strength, flexibility, balance, and motor control [7].

This review paper explores, via narrative interpretation of scientific medical data, the connection between hip muscle function and yoga poses. The review will look at the anatomical and functional characteristics of the hip muscles, how yoga affects the strength, flexibility, and motor control of the hip muscles, as well as the biomechanics of a few different yoga poses. The review also emphasises the advantages of incorporating yoga into the treatment of hip joint conditions.

Anatomy and Function of Hip Muscles

Numerous muscles that surround the hip joint are in charge of regulating hip joint stability and movement [2]. The hip flexors and extensors and the hip abductors and adductors are two groups that make up the hip muscles.

The iliopsoas, rectus femoris, and sartorius muscles make up the hip flexors. In order to perform movements like walking, running, and jumping, these muscles must flex the hip joint [8]. The main hip flexor, the iliopsoas muscle, arises from the lumbar spine and inserts into the femur. The sartorius muscle comes from the anterior superior iliac spine and inserts into the medial surface of the tibia, whereas the rectus femoris muscle originates from the ilium and inserts into the patella and tibia. The hip joint is flexed by these muscles working in tandem.

The gluteus maximus, hamstrings, and adductor magnus muscles are hip extensors. The largest muscle in the body and the main hip flexor is the gluteus maximus. The ilium, sacrum, and coccyx are its places of origin, and it enters into the femur. The biceps femoris, semimembranosus, and semitendinosus are three of the muscles that make up the hamstrings. They come from the ischial tuberosity and insert into the tibia and fibula. The ischium and pubis are where the adductor magnus muscle begins, and it enters into the femur. Together, these muscles help to stretch the hip joint [9-12].

The gluteus medius, gluteus minimus, and tensor fascia latae muscles make up the hip abductors. These muscles are in charge of the hip joint's abduction, which is necessary for motions like walking, running, and sidestepping. The greater trochanter of the femur is where

the gluteus medius and gluteus minimus muscles insert after growing from the ilium. The iliac crest is the muscle's place of origin, and it inserts into the iliotibial band. Together, these muscles help to abduct the hip joint.

The adductor longus, adductor brevis, adductor magnus, pectineus, and gracilis muscles make up the hip adductors. Adducting the hip joint, which is necessary for actions like standing, walking, and crossing the legs, is accomplished by these muscles. The muscles of the adductor longus, adductor brevis, and adductor magnus insert into the femur from the pubis. Both the gracilis and pectineus muscles have their origins in the pubis and insert into the femur and tibia, respectively. Together, these muscles help to adduct the hip joint.

For the hip joint to be stable and mobile, hip muscles must work properly. Hip joint mechanics can be affected by weak or dysfunctional hip muscles, which increases the likelihood of hip joint injury or dysfunction [9]. To prevent and treat diseases of the hip joint, it is crucial to maintain normal hip muscle function.

Effects of Yoga on Hip Muscle Function

Strength, flexibility, and motor control in the hip muscles have all been found to improve with yoga. Numerous studies have looked into how yoga affects both healthy and people with hip joint issues in terms of hip muscle function.

In a 12-week yoga intervention, Sherman et al. [10] looked at the effects on hip muscle strength and flexibility in healthy adults. In comparison to the control group, the yoga group significantly increased hip muscle strength and flexibility, according to the study. The scientists came to the conclusion that yoga could be a useful treatment for enhancing hip muscle function in healthy people.

Another randomised controlled experiment was conducted by Tüzün et al. [11] to examine how a 12-week yoga intervention affected the hip muscles' flexibility and strength in people with hip osteoarthritis. In comparison to the control group, the yoga group significantly increased hip muscle strength and flexibility, according to the study. According to the authors, yoga may be a secure and efficient strategy for enhancing hip muscle function in people with hip osteoarthritis.

Cramer et al.'s systematic review and meta-analysis [9] examined the impact of yoga on balance and mobility in people with Parkinson's disease. The analysis looked at 10 trials, and the findings revealed that yoga practitioners had significantly better balance and mobility than non-yogis did. The scientists hypothesised that increases in hip muscle function may be responsible for yoga's positive benefits on balance and mobility.

Hip muscles' functional structure has been discovered to be significantly influenced by yogic positions [14]. For instance, it has been discovered that the pigeon pose increases hip external rotation range of motion [15], which is crucial for actions like sprinting and jumping. The gluteus maximus and medius muscles, which are crucial for hip extension and abduction, respectively, are also engaged in this stance. The gluteus medius, which is crucial for

preserving balance and stability during activities like walking and running, has also been discovered to be activated in Warrior Pose [13].

Tree Pose has also been shown to boost hip abductor muscle activation and enhance stability and balance [12]. Standing on one leg, elevating the other, and placing the sole of the foot on the inner thigh of the opposing leg constitutes this pose. To maintain stability and balance during this, the hip abductor muscles must be engaged.

Downward-Facing Dog Pose is another yoga position that has been shown to enhance hip muscle performance. The gluteus maximus and medius muscles are engaged as the hamstrings and calves are stretched [13]. This position has been shown to increase total hip range of motion and lessen hip and lower back pain [10].

In general, yoga poses have been reported to improve range of motion, muscle activation, balance, and stability in the hip muscles.

The biomechanics of selected yogic poses and their relationship to hip muscle function

Numerous yoga poses that can enhance hip muscle function call for the activation of hip muscles. The standing stance known as the Warrior II stance necessitates hip abduction, external rotation, and extension. The gluteus medius, gluteus maximus, and quadriceps muscles, which are crucial for hip stability and mobility, are all activated in this position [13]. In addition, by stretching the adductor muscles, Warrior II Pose can increase hip flexibility [14].

Pigeon Pose is another position that enhances hip-muscle performance. Hip flexion and external rotation are necessary for the seated pose known as Pigeon Pose. For hip stability and mobility, the gluteus maximus, piriformis, and other external rotator muscles must be active [15]. By extending the hip flexor muscles, the Pigeon Pose can also increase hip flexibility [16].

In the supine position known as Bridge Pose, the gluteus maximus and hip flexors must be engaged. This position helps to increase the flexibility and strength of the hip muscles [17]. Additionally, Bridge Pose can enhance posture and spinal flexibility.

Standing balance stance known as "Tree Pose" calls for external rotation and hip abduction. The gluteus medius and other hip abductor muscles, which are crucial for hip stability and balance, are activated in this stance [18]. Additionally, by stretching the adductor muscles, the tree pose can increase hip flexibility [19].

Comparison with Other Interventions

It's vital to weigh yoga's effectiveness against that of other therapy, even if it has been shown to be effective in enhancing hip muscle function. For instance, spine manipulative treatment (SMT) has been discovered to have an immediate impact on low back pain sufferers' thermal

pain sensitivity [16]. Additionally effective at easing chronic non-specific low back pain are lumbar stabilisation exercises and thoracic mobilisation [17].

Yoga, however, has certain benefits over these treatments. First of all, because yoga is a low-impact activity, those with joint problems or injuries can practise it. Second, yoga combines relaxation and mindfulness practises that have been shown to increase distress tolerance [18]. Finally, yoga is a highly adaptable intervention because it is simple to modify to individual needs and capabilities [19,20].

Conclusion

For the hip joint to be stable and mobile, hip muscle function is crucial. Hip joint mechanics can be affected by weak or dysfunctional hip muscles, which increases the likelihood of hip joint injury or dysfunction. Strength, flexibility, and motor control in the hip muscles have all been found to improve with yoga. Numerous yoga poses that can enhance hip muscle function call for the activation of hip muscles.

Yoga poses including Warrior II Pose, Pigeon Pose, Bridge Pose, and Tree Pose can enhance hip muscle function. These positions engage the gluteus medius, gluteus maximus, quadriceps, piriformis, and other hip muscles and call for hip abduction, external rotation, extension, and flexion. In order to prevent and treat hip joint diseases, hip muscle strength, flexibility, and mobility must all be improved via practise of these poses.

Incorporating yoga poses that focus on hip muscle function can, therefore, be a successful intervention for enhancing hip muscle function in both healthy people and people with hip joint disorders. More investigation is required to determine the precise mechanisms by which yoga enhances hip muscle function as well as the best yoga interventions for managing and preventing hip joint disorders.

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