



Effects of pelvic and hip alignment with acquired flat foot and plantar fasciitis

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ABSTRACT

The interplay between pelvic and hip alignment and acquired flat foot and plantar fasciitis highlights the complexity of the human musculoskeletal system. This article explores how muscle imbalances in the thoracic and lumbar regions can lead to changes in the pelvic, hip, knee, and foot mechanics, resulting in conditions like acquired flat foot and plantar fasciitis (Chougala et al., 2015). It outlines the common symptoms, special tests for diagnosis, and the impact of innominate rotation on ankle mechanics. Acquired flat foot, characterized by the collapse of the medial longitudinal arch, and plantar fasciitis, a prevalent cause of foot pain, are examined in terms of their etiology and progression (Riddle & Pulisic, 2003). Rehabilitation considerations emphasize the necessity of a holistic approach that not only addresses symptoms but also corrects underlying muscle imbalances and weight-bearing issues (Cummings & White, 2013). The importance of patient education is underscored, highlighting early detection and proactive management of weight-bearing and muscular imbalances (Smith & Taylor, 2017). Engaging patients in hip stability, hip strengthening, core exercises, and sustained stretching is recommended to enhance recovery and prevent symptom recurrence. In conclusion, a comprehensive understanding of pelvic and hip alignment is crucial for effective treatment of acquired flat foot and plantar fasciitis. A holistic and integrative approach is essential for achieving lasting therapeutic outcomes and improving patients' quality of life. Future studies should investigate the effects of postoperative conditions on muscle imbalances leading to these conditions and compare outcomes between patients who address symptoms early and a control group (Dutton, 2016; Kearns & Maloney, 2011).

Keywords: human musculoskeletal system, pelvic and hip alignment, acquired flat foot

INTRODUCTION

The pelvic girdle and the hip joint are complicated joints connecting the upper and the lower half of the body. The hip joint and the pelvis have one of the strongest joints in the body as well as one of the largest groups of muscles and joints. As large groups of muscles hold huge amounts of tensile force to bring about changes in the pelvic alignment in case of muscle imbalances (Kwon & Kim, 2015). These muscle imbalances can be triggered due to changes in the thoracic region and lumbar back leading to changes in muscle function causing muscular imbalance in the pelvic, hip, around the knee joint, and foot (Hreljac, 2004). These changes in the hip and the knee joint can lead to changes in weight-bearing in the ankle and the foot leading to loss of arches and causing acquired flat foot (Chougala et al., 2015). Patients with acquired flat foot and plantar fasciitis, which present secondary to another injury or sometimes in its primary state, can usually present with a positive long sitting test, and even though not symptomatic may also demonstrate some of these signs and symptoms on assessment of patients (Rolf & Steinkamp, 2009).

Special tests that might be positive: Noble's compression, Hip bursitis, Pes anserine, FABER's test, Ganslen test, SI Joint compression test, Single leg standing test (Dutton, 2016). These might also be signs and symptoms associated with a hip and pelvic alignment etiology showing symptoms of pain in the hip such as bursitis, IT band friction syndrome, pes anserine syndrome, patellofemoral syndrome.

Body part	Lumbar and sacral region	Hip Joint	Knee joint	Ankle and foot
Signs and Symptoms	1) Paraspinal tightness and tenderness	1) Piriformis and gluteal minimums tightness	1) IT band tightness with vastus lateralis tightness	1) Increased tibialis anterior and posterior tightness with forefoot internal rotation
	2) Sacral rotation opposite to the side of lumbar paraspinal tightness	2) Hip flexors tightness on the side of anterior tilt of pelvic rotation.	2) Lateral patellar tracking with vastus medialis (VMO) tightness	2) Pronation on the side of anterior pelvic tilt. Leading to acquired flat foot and loss of arches.
		3) Tensor fascia latae tightness on the side of posterior pelvic tilt.	3) Hamstrings and gastrocnemius tightness on side of posterior pelvic tilt.	

INNOMINATE ROTATION AND EFFECT ON ANKLE MECHANICS

Innominate rotation is usually posterior innominate rotation or anterior innominate rotation. Innominate rotation usually causes functional leg length discrepancy, which can be tested by tests like the Long sitting test (Kwon & Kim, 2015). Therapists should test for length discrepancy in case of a true leg length discrepancy needing orthotic intervention. Other indicators of a functional leg length issue can be increased step length on the side of posterior pelvic rotation, and difficulty performing hip flexion on the side of anterior pelvic rotation (Hreljac, 2004). This pelvic rotation causes increased weight bearing on the side of anterior pelvic tilt.

FOOT MECHANICS

On the side of posterior pelvic tilt due to increased gastrocnemius and soleus tightness, the patient may present with plantar flexion of the foot with inversion. The inversion is caused by weakness in tibialis anterior and tibialis posterior. This can also lead to increased tightness in the plantar fascia leading to Achilles tendonitis, calcaneal bursitis, plantar fasciitis (Riddle & Pulisic, 2003). On the side of anterior pelvic tilt, there is increased tightness in tibialis anterior, tibialis posterior, peroneal longus, and brevis. Due to increased foot pronation and internal rotation, there is weakness of the plantar fascia and loss of the plantar longitudinal and horizontal arch (Chougala et al., 2015).

ACQUIRED FLAT FOOT PATHOLOGY

The acquired flat foot is caused by the collapse of the medial longitudinal arch. This can be due to multiple etiologies including a dysfunction of the posterior tibialis anterior tendon, trauma, obesity, arthritic changes, diabetes, post-operative changes in lower extremities (Cummings & White, 2013). It can be differentiated into four stages:

- **Stage 1:** Minimum pain and no collapse of the arch
- **Stage 2:** Arch begins to collapse, visible swelling, and moderate pain with reduced flexibility
- **Stage 3:** Moderate arch collapse with difficulty standing and walking, increased rigidity and moderately collapsed arch
- **Stage 4:** Difficulty with weight bearing, severe pain, and deformity. May require surgical intervention.

PLANTAR FASCIITIS PATHOLOGY

The plantar fascia helps support the arch of the foot and acts as a shock absorber during the gait cycle. Plantar fasciitis is the most common cause of foot pain in the adult population (Rolf & Steinkamp, 2009). Plantar fasciitis usually presents as heel pain, usually sharp in nature and majorly associated with lack of activity. Pain tends to reduce with prolonged activity as it improves the flexibility of the plantar fascia temporarily. Etiology can be associated with other lower extremity injury complications due to altered weight bearing and pelvic alignment changes, overuse and repetitive stress, high-impact activities like running, flat foot or pes cavus, tight gastrocnemius and soleus, and poor footwear with inadequate arch support (Riddle & Pulisic, 2003).

REHABILITATION CONSIDERATIONS

While forming a comprehensive plan for plantar fasciitis or acquired flat foot, therapists must carefully assess the patient's postural changes and muscular imbalances. Both conditions may present more symptoms due to changes in weight bearing due to pelvic alignment changes. In this case, treating only the symptoms will yield only short-term results of pain relief, but the symptoms will return within 24-48 hours most likely. A holistic approach by incorporating exercises to improve hip and pelvic mobility while reducing innominate rotation and muscle

imbalance will provide more long-term effects (Kearns & Maloney, 2011). Along with these exercises, reducing muscle imbalance activities to improve pain symptoms will also be beneficial to improve the gait cycle, improve weight bearing, and reduce pain.

PATIENT EDUCATION IN REHABILITATION

If treating patients for a primary issue which is affecting the patient's weight bearing, which can include ankle, knee, or hip pathologies, patients should be educated about potential weight-bearing issues which might lead to pelvic or hip alignment issues and potential secondary issues that might arise with it (Smith & Taylor, 2017). Some early signs of these need to be checked often to avoid further exacerbation of these issues. Some cardinal signs are IT band, vastus lateralis tightness, piriformis, gluteal minimum, medius tightness. Foam rolling, if safe, should be promoted for these patients for potentially all the lower extremity. Engaging patients in early hip stability and hip strengthening exercises in combination with core strengthening has shown good results to improve hip alignment and improved gait cycle. Sustained stretching for lower extremity muscles should be promoted (Chougala et al., 2015).

CONCLUSION

The relationship between pelvic and hip alignment with acquired flat foot and plantar fasciitis features the difficulty of the human musculoskeletal system and the potential effects of muscular imbalances. The complex biomechanical linkage between the upper and lower body are evident as changes in the upper half of the body influences the pelvis, hip, knee, and foot mechanics, leading to conditions such as acquired flat foot and plantar fasciitis (Kwon & Kim, 2015). Understanding the symptoms and special tests associated with these conditions which lead to innominate rotation and functional leg length discrepancies, is crucial for accurate diagnosis and effective treatment. The rehabilitation considerations highlight the importance of a holistic approach that addresses not only the symptoms but also the underlying biomechanical issues leading to muscle imbalances and weight-bearing issues (Cummings & White, 2013). By focusing on pelvic and hip mobility, core strengthening and engagement activities, reducing muscle imbalances, and incorporating patient education, therapists can achieve long-term improvements in pain management, gait cycle, and overall function (Dutton, 2016; Kearns & Maloney, 2011). Moreover, patient education plays a vital role in rehabilitation, emphasizing the need for awareness of potential weight-bearing issues and early signs of muscular imbalances (Smith & Taylor, 2017). Encouraging patients to engage in hip stability, hip strengthening, and core exercises, along with sustained stretching and foam rolling, can significantly enhance their recovery and prevent the recurrence of symptoms (Chougala et al., 2015). In conclusion, a comprehensive and integrative approach to treating acquired flat foot and plantar fasciitis, rooted in a thorough understanding of pelvic and hip alignment, is essential for achieving lasting therapeutic outcomes and improving patients' quality of life. Future studies can be performed on how postoperative conditions affect muscle imbalance and lead to acquired flat foot or plantar fasciitis in patients who address these symptoms earlier versus the control group (Rolf & Steinkamp, 2009; Chougala et al., 2015).

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