Estimates of the prevalence of running injuries range from 37% to 56%, with the majority of injuries affecting the lower extremity. The recurrence of running injuries has been reported to be as high as 70%, with about 20% to 70% of all running-related injuries leading to a medical consultation. Risk factors for running-related injuries have not been conclusively established, but recent research suggests that novice runners may possess elevated injury risk with a high body mass index (BMI), history of prior injury, lack of prior running experience, or lack of prior participation in a sport that involves axial loading of the spine and lower extremities.

The most common injuries associated with running include patellofemoral pain syndrome, iliotibial band friction syndrome, Achilles tendinosis, medial tibial stress syndrome, and plantar fasciitis. Such injuries tend to have clear clinical presentations, which support the accurate diagnosis of a given condition; however, accurate diagnosis of the cause of acute or chronic hip pain in runners can be challenging. Up to 60% of patients who ultimately undergo hip arthroscopy are initially misdiagnosed.

A search of the literature identified two case reports that described rehabilitation following arthroscopic hip surgery, one case report of nonoperative rehabilitation for hip arthrosis and one case series describing the nonoperative rehabilitation of patients with a hip labrum tears. No published reports were found pertaining to female recreational runners with acute or chronic hip pain.

The purpose of this case report is to describe the rehabilitation program for a 25-year-old female recreational runner who had a 4-year history of left hip pain using the principles of regional interdependence (RI). The term RI refers to a broader examination approach that has the goal of identifying unrelated impairments in remote bodily regions that may contribute to the primary source of pain. This approach can be applied to both the examination and rehabilitation of patients.

Case Report

A 25-year-old female recreational runner (i.e., 10 to 20 miles per week) who had a combined endomorph-mesomorphic body structure (Mass: 58.96 kg; Height: 165.1 cm; BMI: 21.6) presented with recurrent hip pain. She reported a history of ankle arthroscopic surgery for excision of a nonunion distal fibular fracture of the left fibula. Postsurgery physical therapy was deemed successful, which allowed return to pain-free physical

Key Points

Recent research suggests that novice runners have elevated risk for injury, particularly those who have previously been injured and who have a high BMI.

The regional interdependence approach may help the clinician identify impairments in remote body regions that contribute to the primary source of pain.

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Management of Hip Pain in a 25-Year-Old Female Runner
activity that included running and resistance exercises. Nine months later, the patient suffered a recurrence of left hip pain with no known precipitating event. She sought evaluation by an orthopedic surgeon for symptoms of anterior hip pain, occasional clicking and popping, and pain with internal rotation of the hip joint. Radiographs and an MR arthrogram were negative for any soft-tissue or bony abnormalities. The patient was diagnosed as having a hip flexor strain, and she continued her regular exercise program. For the next 3 years, the patient continued to have intermittent left hip pain, which was exacerbated by a fall from a mountain bike. The patient was evaluated by her primary care physician for complaints of anterior hip pain after the traumatic event. The physician diagnosed the patient as having sustained an acute aggravation of chronic left hip pain and referred her to physical therapy.

At the initial visit, the patient completed the Lower Extremity Functional Scale (LEFS) to document her functional abilities. The minimal detectable change and minimal clinically important difference for the LEFS is 9 points. The patient LEFS score was 76\% (61/80 possible points). She reported the greatest difficulty with usual hobbies, recreational or sporting activities, squatting, and sitting greater than 1 hour. The patient reported a pain level of 3/10 during athletic activity (e.g., yoga), squatting, prolonged sitting (> 1 hour), and rotational hip motions. Her pain was decreased to 2/10 pain with medication. The patient reported the location of pain to be in the anterior hip area. She demonstrated the “C-sign” (Figure 1) by cupping her hands in a c-shape above the greater trochanter, which has been reported as a common pattern of hip pain.

A general postural screen in a standing position revealed an anteriorly tilted pelvis and a mild degree of right trunk shift. Observation of gait revealed decreased left hip motion (i.e., decreased step length) and a lateral weight shift during the stance phase on the left foot. The patient’s hip, knee, and ankle ROM were tested both actively and passively. Bilateral measurements were within normal limits and symmetrical, with the exception of the left hip. Passive ROM measurements of the left hip were 90° flexion, 25° internal rotation (painful), 30° external rotation, 25° abduction, 10° adduction, and 0° extension.

Manual muscle testing identified strength deficits in both the left hip and ankle compared to the right side (Table 1). Ober’s test (i.e., iliobibial band tightness), 90/90 hamstring test (i.e., hamstring tightness), Thomas test (i.e., hip flexor tightness), and Ely’s test (i.e., rectus femoris tightness) were all interpreted as positive for the left extremity. The Ober’s test and 90/90 hamstring test were interpreted as positive for the right extremity.

Tenderness elicited by palpation of the left hip musculature was assessed on a 0-4 scale (Table 2).
Discussion

The outcome for this case report was consistent with the findings of Snyder et al., who reported that resistance training of the hip musculature improved lower extremity biomechanics during running. Similar findings have been reported for runners with patellofemoral pain syndrome and iliotibial band syndrome.

A unique aspect of the reported case report was the existence of both proximal and distal influences on the patient’s lower extremity function, which required an RI approach to the rehabilitation process. Research has clearly demonstrated that both proximal and distal factors can influence lower kinetic chain kinematics in runners. Thus, the patient’s combined lumbo-pelvic-hip and lower leg impairments may have created dysfunction affecting the entire kinetic chain of the left lower extremity.

The patient presented combined abnormalities that were consistent with the Pelvic Cross Syndrome (PCS) described by Janda. PCS is a condition that is characterized by “overactive” muscles, which may include the rectus femoris, iliopsoas, and thoraco-lumbar extensors, and “underactive” (i.e., inhibited) muscles, which may include the abdominals, gluteus minimus, medius, and maximus. For the case reported, the patient presented with overactive anterior musculature,
### Table 3. Rehabilitation Program

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<th>Timeline</th>
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| **Week #1** | **Focus:** restore muscular symmetry across the hip and pelvis; begin strengthening of the abdominal core and left ankle.  
**Strengthening/Balance:** core strengthening (e.g., abdominal bracing) and ankle exercises (e.g., resistance bands). Single limb balance activity on a stable surface.  
**Manual Therapy/Stretching:** soft tissue management of the surrounding hip musculature with emphasis on the iliopsoas, rectus femoris, iliotibial band complex, and hamstrings. Graded joint mobilization using a belt for general distraction of the hip. Static stretching focusing on the iliopsoas, quadriceps, gluteals, hip external rotators, hamstrings, and iliotibial band complex.  
**Cardiovascular/ROM:** stationary biking for up to 20 minutes with light to moderate resistance.  
**Home Program:** stretching, core strengthening, ankle strengthening, and stationary biking. |
| **Week #2** | **Focus:** begin basic strengthening, functional movements, and progress core strengthening.  
**Strengthening/Balance:** Sidelying hip abduction, clams, double leg bridges, and leg press. Core strengthening and balance activity were progressed with the addition of planks and single leg stance on the foam pad.  
**Manual Therapy/Stretching:** soft tissue management continued with emphasis on the iliopsoas and rectus femoris. Joint mobilization included graded anterior to posterior glides and long-axis distraction. Stretching activities continued with the addition of self-myofascial release with the foam roll.  
**Cardiovascular:** stationary biking for up to 20 minutes with light to moderate resistance.  
**Home Program:** Week I activity with the addition of the foam roll and cardiovascular conditioning with the elliptical trainer. |
| **Reassessment** | *Formal reassessment conducted between week #2 & #3*  
**ROM:** pain free left hip internal rotation of 35 degrees (10 degree increase)  
**MMT:** all hip & knee manual muscle tests were graded a 4/5.  
**Special Testing:** FADIR test of the left hip was negative (no pain)  
**Function:** Poor eccentric control with lunge, single leg squat, and multidirectional toe touching. |
| **Week #3** | **Focus:** continue strengthening and introduce functional movements.  
**Strengthening/Balance:** continuation of basic stretching, self-myofascial release, core and lower extremity strengthening with the addition of closed kinetic chain (CKC) functional activity. CKC exercises including lunges, side-steps, and single leg squats. Balance was further progressed with activity on the BOSU® trainer.  
**Manual Therapy/Stretching:** continuation of soft tissue management of the hip musculature and graded joint mobilization to maintain joint mobility. Stretching activities continued with the addition of self-myofascial release with the foam roll.  
**Cardiovascular:** cardiovascular activity was progressed with light treadmill jogging.  
**Home Program:** week I and week II activity with the addition of CKC activity and light treadmill jogging.  
**Strengthening/Balance:** sports specific activity including multidirectional agility drills (e.g., ladder drills), and movements on the TRX® suspension training system including single leg squats (Figure 2) and side lunges (Figure 3a, 3b). Advanced balance activity was introduced including single leg balance and bilateral squats on air filled discs.  
**Manual Therapy/Stretching:** continuation of soft tissue and joint mobilization as needed to maintain adequate soft tissue and joint mobility. Dynamic warm-ups were introduced prior to activity and stretching and foam roll techniques were continued after physical activity.  
**Cardiovascular:** progressive jogging on the treadmill and outdoor track.  
**Home Program:** week II-week IV activity |
| **Week #4** | **Focus:** return to pain free running and gym activity.  
**Strengthening/Balance:** sports specific activity including multidirectional agility drills (e.g. ladder drills), and movements on the TRX® suspension training system including single leg squats (Figure 2) and side lunges (Figure 3a, 3b). Advanced balance activity was introduced including single leg balance and bilateral squats on air filled discs.  
**Manual Therapy/Stretching:** continuation of soft tissue and joint mobilization as needed to maintain adequate soft tissue and joint mobility. Dynamic warm-ups were introduced prior to activity and stretching and foam roll techniques were continued after physical activity.  
**Cardiovascular:** progressive jogging on the treadmill and outdoor track.  
**Home Program:** week II-week IV activity |
which included the iliopsoas and rectus femoris, and underactive posterior musculature, which included the gluteus maximus.

The patient’s rehabilitation program incorporated strengthening exercises that were selected to correct the identified muscle imbalance. Sherriton emphasized the “Law of Reciprocal Inhibition” as a means to address muscle imbalance, which employs the principle that agonist contraction promotes relaxation of antagonist muscles. Thus, a primary focus of the patient’s rehabilitation was reduction of hypertonicity and restoration of normal extensibility of the iliopsoas (overactive), and improvement of strength in the gluteal muscles (underactive). To address the residual impairment of lower leg strength and ankle function from the earlier fibula fracture and surgical procedure, restoration of optimal ankle strength and postural balance were emphasized. Research has demonstrated that poor hip kinematics and impaired postural stability can be associated with a history of ankle sprains.27,28

The FADIR test has been reported to have excellent sensitivity (0.91 to 1.0) and positive predictive value (0.65 to 1.0).29 Despite the previous negative finding of an MR arthrogram, the patient demonstrated a positive FADIR test during the initial physical therapy examination. Hypertonicity and tightness of the anterior hip musculature can elicit symptoms that are similar to those of FAI. After two weeks of rehabilitation, the patient’s FADIR test was negative.

**Summary**

This report describes the successful management of chronic hip pain in a young female runner whose case demonstrated regional interdependence. The information presented in this report may help guide clinicians in the development of effective rehabilitation programs for similar cases.

**References**


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