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About The Author

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This chapter focuses on common musculoskeletal injuries of the lower extremity. Particular attention will be placed on recognition, management, and restorative exercise guidelines for the selected topics. A thorough understanding of common non-operative and post-operative musculoskeletal conditions is necessary to make accurate assessments and to know when to refer to other healthcare professionals.

Screening the Client

In addition to the general health information obtained from questionnaires such as the Physical Activity Readiness Questionnaire (PAR-Q), more specific screening questions are needed to obtain a complete history from the client. It is important to understand what interventions have been done and at what stage in the healing process the client is currently. The following screening questions are recommended prior to designing a restorative program:

- How did the injury happen (i.e., the mechanism of injury)?
- Did the client see his or her physician? If yes, what treatment has been done (e.g., surgery, physical therapy, oral medications, cortisone injection)?
- Did the physician issue any exercise precautions or contraindications (e.g., limit walking to 15 minutes)?
- What type of symptoms is the client feeling (e.g., “sharp” pain when walking on the treadmill)?
- Does the client have any functional limitations (e.g., unable to lift objects overhead)?
- What is the client’s tolerance to activity (e.g., “feeling fatigue” after 10 minutes of treadmill walking)?

These questions will help guide the ACE-AHFS in answering the single most important question: Is this client appropriate for exercise at this time?

Principles of Restorative Exercise

The design of a restorative exercise program needs to be specific to the client’s goals and functional abilities. Typically, when a client is recovering from an injury or is post-surgical, restorative exercise programs can help him or her regain flexibility, strength, proprioception, and endurance, and provide positive progress toward more functional or sport-specific activities. There are many different approaches to designing a restorative exercise program. The most effective programs take into account the individual’s functional abilities, recovery status (e.g., stage of healing), prior activity level, comorbidities (e.g., diabetes), and goals (Brotzman & Wilk, 2003). If a post-injury or post-surgical client undergoes rehabilitation, the physical therapist typically addresses...
these principles. Typically, the role of the ACE-AHFS is to progress what has been done in rehabilitation and help the client transition back to full function. The timelines given for returning to fitness activities are general recommendations and may be different among individuals due to the doctor’s guidelines. In fact, the ACE-AHFS may see these clients earlier in the timeline based on their unique situation. For each topic discussed in this chapter, exercise recommendations are categorized into flexibility, strengthening, and functional integration. These categories are given for organization and ease of reference.

Flexibility

Flexibility is defined as the range of motion (ROM) of a joint, which can be limited by joint structure, neuromuscular coordination, muscle strength of opposing groups, and the mobility of the soft tissues (e.g., muscles, ligaments, and connective tissue) associated with the joint (Brotzman & Wilk, 2003). Most flexibility programs utilize various forms of stretching and myofascial release to achieve the desired level of flexibility. Common techniques include static stretching, proprioceptive neuromuscular facilitation (PNF), and myofascial release using a foam roller.

Strengthening

Strengthening of the post-injury or post-surgical client is very important to the success of the program. When an individual is recovering, there may be a decline in neuromuscular control, muscular strength, and local muscular endurance. Utilizing progressive resistive exercises (PREs) will ensure adequate progression of strength and endurance. This technique uses the overload principle to challenge the client as he or she gets stronger. Increasing the weight by 5% with each set is an example of PREs. The goal is to safely overload the tissue in a progressive fashion.

Strengthening exercises can be classified into two main categories: open kinetic chain (OKC) and closed kinetic chain (CKC). OKC exercises are non-weightbearing, with the distal end (e.g., the foot) free, and involve isolating a specific muscle group. The leg extension machine and sidelying hip abduction are examples of open chain activities. CKC exercises have the distal end fixed and are typically more functional. Examples include squats and lunges. CKC exercises are often thought to be superior due to joint compression, muscle co-contraction, and increased functionality (Manske, 2006).

Functional Integration

Functional training describes specific activities that help to train the body for activities performed in life (Brotzman & Wilk, 2003). This term is used here to describe the integration of restorative exercise principles, which include flexibility, strength training, and proprioception.

Proprioception can be defined as a person’s awareness of his or her body in space. Proprioception is part of the sensory system that detects joint movement (kinesthesia) and joint position (proprioception). Balance is dependent on sensory receptors, which are located in muscles, skin, tendons, ligaments, and joints. The central nervous system (CNS) receives input from these receptors along with visual and vestibular input, which are used to control body position and balance (Anderson, Hall, & Parr, 2008). When injury occurs, these pathways can be diminished due to trauma or disuse, which leads to poor balance and increased risk for injury. Retraining these pathways is necessary to maintain adequate neuromuscular control during functional and athletic activities. Proprioceptive exercises must be specific to the activity and should follow a graduated progression that includes the following principles: slow to fast, low force to high force, and controlled to uncontrolled movement (Anderson, Hall, & Parr, 2008).

Therefore, functional integration represents exercises that are specific to the activity or sport and reflect the client’s physical abilities and performance goals. Specific functional integration strategies are discussed along with cardiovascular recommendations for the specific topics covered in this chapter.
Musculoskeletal Injuries of the Lower Extremity

Chapter eighteen

Hip Pathologies

The Iliotibial Band Complex

The iliotibial band (ITB) complex is a band of fibrous connective tissue (fascia) on the outside of the femur that goes from the hip to the knee. Proximally, the gluteals and tensor fasciae latae (TFL) both blend into the upper fibers of the ITB. This is the region where trochanteric bursitis occurs. The lower fibers of the ITB attach distally to the proximal anterolateral tibia (Gerdy’s tubercle) and also attach to the patella and biceps femoris via fascial connections (Brotzman & Wilk, 2003). This is also the region where iliotibial band friction syndrome (ITBFS) occurs. The function of the ITB complex is to serve as a shock absorber and lateral stabilizer. Problems in this complex are common among both active and sedentary individuals (Brotzman & Wilk, 2003). Acute or repetitive overuse can tighten the ITB complex, resulting in microtears of the fascia that can lead to scar tissue and functional shortening of the ITB over time (Brotzman & Wilk, 2003; Foye & Stitik, 2006).

Trochanteric Bursitis

Trochanteric bursitis is characterized by painful inflammation of the trochanteric bursa between the greater trochanter of the femur and the gluteus medius/iliotibial complex (Bierma-Zeinstra et al., 1999). This condition is becoming more common; approximately 10 to 20% of patients seeing their doctors for hip problems have pain over the trochanteric region (Bierma-Zeinstra et al., 1999). This condition is more common in female runners, cross country skiers, and ballet dancers (Lievense, Bierma-Zeinstra, & Schouten, 2005; Anderson, Hall, & Parr, 2008). Inflammation of the bursa may be due to an acute incident or repetitive (cumulative) trauma. Acute incidents may include trauma from falls, contact sports (e.g., football), and other sources of impact. Repetitive trauma may be due to excessive friction by the ITB. Factors such as prolonged running, an increase or change in activity, leg-length discrepancy, and lateral hip surgery have been described as causes of repetitive trauma (Foye & Stitik, 2006). Research shows a higher prevalence rate of trochanteric bursitis with low-back pain and osteoarthritis of the hip (Lievense, Bierma-Zeinstra, & Schouten, 2005; Foye & Stitik, 2006).

Iliotibial Band Friction Syndrome

Iliotibial band friction syndrome (ITBFS) is a repetitive overuse condition that occurs when the distal portion of the iliotibial band rubs against the lateral femoral epicondyle (Brotzman & Wilk, 2003; Anderson, Hall, & Parr, 2008). As the knee moves from full extension to approximately 30 degrees of flexion, the ITB moves from an anterior position to the lateral femoral epicondyle to a posterior position. The repeated flexion and extension of the knee causes the ITB to pass back and forth over the lateral femoral epicondyle, leading to irritation and inflammation (Brotzman & Wilk, 2003). ITBFS is common among active individuals 15 to 50 years of age and is primarily caused by training errors during running, cycling, playing volleyball, and weightlifting (Martinez & Honsik, 2006; Anderson, Hall, & Parr, 2008). Risk factors may include overtraining, changes in running surface, structural abnormalities (pes planus, bow-legs, and leg-length discrepancy), muscle imbalance, and muscle tightness (Martinez & Honsik, 2006; Brotzman & Wilk, 2003). Signs and symptoms, precautions, and restorative exercise strategies for both pathologies are discussed in the following sections.

Signs and Symptoms of Trochanteric Bursitis and ITBFS

Trochanteric bursitis pain and/or parasthesias (i.e., tingling, prickling, and numbness) often radiate from the greater trochanter to the posterior lateral hip, down the iliotibial tract, to the lateral knee (Little, 1979). Symptoms are most often related to an increase in activity or repetitive overuse. Aggravating activities may include lying on the affected side, prolonged walking/running, and certain hip movements (internal and external rotation). Deficits in hip strength, ROM, and gait may be present secondary to the pain. The client may walk with a limp (i.e., Trendelenburg gait) due to pain or weakness. He or she may develop a compensation pattern through the painful limb that
directly affects the lower kinetic chain. This may result in decreased muscle length (e.g., in the quadriceps or hamstrings), myofascial tightness (e.g., in the ITB complex), and weak, inhibited muscles.

Clients with ITBFS often report a gradual onset of tightness, burning, or pain at the lateral aspect of the knee during activity. The pain may be localized, but generally radiates to the outside of the knee and/or up the outside of the thigh. Snapping, popping, or pain may be felt at the lateral knee when it is flexed and extended (Brotzman & Wilk, 2003; Anderson, Hall, & Parr, 2008; Martinez & Honsik, 2006).

Aggravating factors may include any repetitive activity such as running (especially downhill) or cycling. Symptoms often resolve with rest but can increase in intensity and frequency if not properly treated. The client may present with weakness in the hip abductors, ITB shortening, and tenderness throughout the ITB complex (Martinez & Honsik, 2006; Brotzman & Wilk, 2003).

Precautions
There are no direct precautions for either trochanteric bursitis or ITBFS. Clients are advised to avoid any aggravating activities and return to activity in a slow, systematic manner. When a client is ready to return to fitness activities, a written clearance from his or her physician may be necessary. More specifically, clarification from the physician or physical therapist regarding what the client can and cannot do would help guide the ACE-AHFS when designing the restorative exercise program.

Early Intervention
Conservative treatment of trochanteric bursitis and ITBFS often includes avoiding aggravating activities, physical therapy, modalities (e.g., ice, heat), assistive devices (e.g., a cane), oral anti-inflammatory medication, cortisone injections, or surgery (Foye & Stitik, 2006). Once the client is cleared for more advanced activity, the restorative exercise program should progress from what has already been done in treatment and rehabilitation.

Restorative Exercise Program for Trochanteric Bursitis and ITBFS
When designing the program, the ACE-AHFS should include client education. Important components include proper training techniques, appropriate footwear, and early injury recognition. The client should be pain free with activity and should be reminded to use ice after the workouts to prevent any latent discomfort or inflammation. The following restorative exercise principles are recommended.

Flexibility
For trochanteric bursitis and ITBFS, muscle tightness and myofascial restrictions should be addressed to restore proper length and symmetry to the hip and thigh region. Particular emphasis should be placed on the ITB complex and the surrounding muscles. Due to their fascial connections, tightness or decreased length in the biceps femoris, vastus lateralis, and gluteus medius can directly impair mobility. Tightness often leads to friction over the proximal greater trochanteric bursa or the distal femoral epicondyle. These muscle and fascial connections are often called the mechanical interface to the ITB complex. Stretching should target these areas and may include static stretching, assisted PNF stretching, and myofascial release of the ITB complex using a foam roller (Figure 18-1).
Strengthening

For both conditions, the focus of strengthening should be to restore proper neuromuscular control throughout the hip region and abdominal core. The gluteals, hip abductors, adductors, and external rotators should be the focus of strengthening. At this point, isolated open-chain strengthening may still be necessary due to local weakness, endurance deficits, and poor muscle recruitment. Examples of isolated hip exercises include side-lying abduction and adduction, and side-lying hip abduction/external rotation “clams” (Figure 18-2).

Functional Integration

For both pathologies, the functional program should focus on challenging the abdominal core and hip complex. CKC exercise can be introduced to integrate more functional activity, which can be progressed in all planes of motion (Table 18-1). Challenging the client through functional exercise will help to prepare him or her for more advanced activity or sport-specific training.

Deficits in general balance may be evident due to disuse of the kinetic chain. Basic progression of balance activities can be combined with CKC activities to challenge the client. For example, a single-leg squat on an air-filled disc combines CKC and proprioceptive exercise. Simply combining an unstable surface with different modes of exercise can be an efficient way of challenging a client (Table 18-2).

Cardiovascular conditioning is essential for recovery and overall health. The client should return to cardiovascular activity in a slow, progressive manner. Running, prolonged walking, and cycling have been associated with both trochanteric bursitis and ITBFS. Cardiovascular activities such as riding a stationary bike or using an elliptical trainer can be alternatives until the client is cleared to continue with higher-loading activities.

**Hip Osteoarthritis**

**Osteoarthritis Facts**

Osteoarthritis (OA), or degenerative joint disease, is the most common form of arthritis. Buckwalter and Martin (2006) report that approximately 20 million Americans have OA, and the World Health Organization (WHO)