IN THIS CHAPTER:

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16

Exercise Programming Considerations and Guidelines

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ACE-certified Health Coaches assist a variety of individuals with specific goals and needs. Due to the prevalence of inactive lifestyles and increased caloric consumption in modern society, as well as genetic factors that may lead to the excess accumulation of **body fat,** health coaches will most likely serve a high percentage of clientele who are **overweight** or obese. **Obesity** is defined as a **body mass index (BMI)** ≥30 kg/m^2, whereas overweight is classified as a BMI between 25 and 29.9 kg/m^2.

Together, overweight and obesity affect more than two-thirds of the adult population in the United States, which is a trend that has been rising for more than a century, with a substantial increase noted in the past several decades (Ogden et al., 2006; Helmchen & Henderson, 2004).

Obesity is associated with many other adverse health conditions, including **cardiovascular disease (CVD)**, **type 2 diabetes**, and the **metabolic syndrome** [National Heart, Lung, and Blood Institute (NHLBI), 1998]. In addition, chronic obesity may lead to functional impairment (Jensen, 2005) and reduced quality of life (Fontaine & Barofsky, 2001), as well as to greater **mortality** (Fontaine et al., 2003). Fortunately, when treatment is successful at producing even small amounts of weight loss, obese individuals experience many health benefits, including prevention of disease (especially type 2 diabetes) (Knowler et al., 2002) and reduced mortality rate (Bray, 2007). These factors, in combination with the estimated direct and indirect costs of obesity-related conditions, which exceed $117 billion in the United States annually, make treating obesity a national healthcare priority (Stein & Colditz, 2004).

The basis for managing body weight is founded upon energy balance, which is influenced by energy intake (i.e., caloric consumption) and energy expenditure.

Physical activity and structured exercise programs play an important role in weight management because they contribute to long-term weight loss by facilitating energy expenditure. Overweight and obese individuals can achieve weight loss when they expend more daily **calories** on average than they consume.

The energy expenditure provided by increased physical activity and/or structured exercise appears to have minimal impact on weight loss for obese individuals in the initial six months after adopting an intervention program. Only modest reductions in body weight (an average of 2 to 3% decrease) are observed with increased physical activity in overweight and obese adults at the beginning of a weight-reduction program (NHLBI, 1998). This is likely due to the fact that most individuals with excess body fat have low **cardiorespiratory fitness** and cannot tolerate—at least initially—the volume and intensity of exercise required to dramatically impact increases in energy expenditure to drive accelerated weight loss. However, physical activity does appear to be important in the long-term for sustaining significant weight loss and preventing weight regain [American College of Sports Medicine (ACSM), 2009], especially as individuals become more fit and are able to sustain higher volumes of exercise. Furthermore, a review of the literature suggests that diet plus exercise, rather than diet only or exercise only, produces significantly greater weight loss at 12 months, 18 months, and 36 months after the adoption of a weight-loss intervention (Avenell et al., 2004). Thus, the influence of managing caloric intake through healthy eating behaviors is an important factor in long-term weight-loss success that must not be overlooked, and should be coupled with regular physical activity for the greatest impact. It is important to note that an initial weight loss of as little as 10% of body weight can significantly decrease the severity of obesity-associated **risk factors** (e.g., **hypertension** and **insulin resistance**) and is recommended as an appropriate initial goal for obese adults (NHLBI, 2000).

Special Considerations for Overweight/Obese Individuals

Apart from the generally accepted and agreed upon view of obesity as the accumulation of excess body fat, it is an increasingly complex health condition. In their report, *Obesity as a Disease: A White Paper on Evidence and Arguments Commissioned by the Council of the Obesity Society*, Allison and colleagues (2008) unanimously and strongly stated that:

- Obesity is a complex condition with many causal contributors, including many factors that are largely beyond individuals' control.
- Obesity causes much suffering.
- Obesity usually contributes to ill health, functional impairment, reduced quality of life, serious disease, and greater mortality.
- Successful treatment, although difficult to achieve, produces many benefits.
- Obese persons are subject to enormous societal stigma and discrimination.
- Obese persons deserve better.

While it is clear that obesity poses many health challenges, there is controversy as to whether obesity is a disease. Labeling the condition a disease may be beneficial, as it might solicit more resources to the research, prevention, and treatment of obesity, and it could reduce the stigma and discrimination directed at many obese persons. One of the problems with categorizing obesity as a disease is that there are no specific universal symptoms shared among obese individuals and there is only one sign—excess body fat (Allison et al., 2008). Regardless of whether or not obesity is technically called a disease or an adverse health condition, being obese places individuals at an increased risk for **chronic disease** and impaired function.

Common Comorbidities Associated With Overweight/Obesity

The NHLBI (1998) has reported some well-recognized associations between obesity and risk factors for CVD. In individuals with type 2 diabetes, hypertension, or **dyslipidemia**, the percentage of those subjects who were overweight or obese was 82%, 85%, and 84%, respectively (NHLBI, 1998). Of particular importance is the relationship between body fat that is localized in the abdominal area (i.e., **visceral adiposity**) and systemic inflammation. Evidence suggests that CVD, type 2 diabetes, and the metabolic syndrome are all linked to the proinflammatory state associated with abdominal obesity (Lee & Pratley, 2007; Wisse, 2004; Fasshauer & Paschke, 2003). It has been reported that visceral **adipose** tissue secretes several proinflammatory substances (e.g., **interleukin-6**, **tumor necrosis factor-alpha**, and **C-reactive protein**) and that greater levels of visceral adiposity result in higher circulating concentrations of these substances (Panagiotakos et al., 2005; Park, Park, & Yu, 2005). Obese individuals should be carefully screened for **cardiometabolic diseases** (e.g., CVD, type 2 diabetes, and the metabolic syndrome), as these disorders must be taken into consideration when designing exercise programs for this special population.

Fortunately, increased physical activity and/or fitness may attenuate the systemic inflammation associated with visceral adiposity (Mora et al., 2006; Panagiotakos et al., 2004; Church et al., 2002). Evidence also suggests that being physically active can reduce the risk of cardiovascular or all-cause mortality associated with being overweight or obese (Farrell et al., 2002; Lee, Blair, & Jackson, 1999). Additionally, regular exercise (especially moderate to vigorous activity) has been shown to reduce the risk of developing type 2 diabetes (Morrato et al., 2007; Sullivan et al., 2005).

Biomechanical Concerns

In overweight and obese individuals, the musculoskeletal system may experience structural changes that result in low-back pain, decreased **mobility**, modification of the gait pattern, and changes in the relative energy expenditures for a given activity. In addition, **osteoarthritis**, particularly of the knee, is strongly associated with increases in BMI.

Obesity and Low-back Pain

While the association between obesity and low-back pain is unclear, researchers have reported a linear correlation between increasing BMI and low-back pain, especially in large population studies (Leboeuf-Yde, 2000; Toda et al., 2000; Han et al., 1997). There also appears to be a higher incidence of low-back pain in obese women versus obese men (Shiri et al., 2010; Shiri, 2008).

Altered **posture** and a lack of spinal mobility could be underlying causes of low-back pain in obese individuals. Vismara et al. (2010) compared the spines of obese subjects with normal-weight controls and found significant differences at the lumbar, pelvic, and thoracic levels among the groups. Obesity seems to induce an increase in **anterior** pelvic tilt. The increased anterior pelvic tilt induces a greater **flexion** of the sacroiliac joints, which produces undue strain on the L5-S1 joint and surrounding intervertebral discs. This could lead to degenerative deterioration of those discs (i.e., **degenerative disc disease**). There have also been reports of increased lumbar **lordosis** in obese individuals with chronic low-back pain (Vismara et al., 2010; Gilleard & Smith, 2007). At the level of the thoracic spine, Vismara et al. (2010) found that **range of motion (ROM)** during spinal forward flexion was significantly lower in obese subjects and in obese subjects with chronic low-back pain as compared to normal-weight subjects. Stiffness in the thoracic spine translated to forward flexion performed mainly by the lumbar spine, which is most frequently involved in pain **syndromes.**

The postural differences noted above confirm the "kinetic chain" relationship of the musculoskeletal system, such that if a joint experiences stiffness or immobility, nearby joints will sacrifice **stability** and become more mobile to ensure that important bodily movements occur. In the case of obesity, it appears that a rigid thoracic region along with a chronic anterior pelvic tilt forces the lumbar spine (the area located between the thoracic spine and the pelvis) to exceed its normal flexion capabilities, potentially leading to low-back pain. The Vismara et al. (2010) findings, along with others (Lehman, 2004; Nourbakhsh & Arab, 2002), suggest that obese individuals should include strengthening of the lumbar and abdominal muscles as well as mobility exercises for the thoracic spine and pelvis to prevent or reduce chronic low-back pain.

Another biomechanical factor that could contribute to low-back pain in the obese population is increased abdominal circumference and its affect on the function of the muscles that support the spine. In fact, researchers have reported findings that suggest that abdominal obesity is the primary weight-related risk factor for low-back pain (Shiri, 2008; Han et al., 1997). Increased abdominal mass shifts the body's **center of gravity (COG)** forward, farther away from the lumbar spine. The constant efforts of the erector spinae muscles to counteract the pull created by excess abdominal fat may jeopardize the muscles' function of reducing anterior shear forces on the lumbar spine (McGill, Hughson, & Parks, 2000). Other effects of overworked erector spinae muscles include insufficient muscle force output, inappropriate neuromuscular activation, and muscular fatigue (Descarreaux et al., 2008), which are all detrimental to the stability of the spine.

A high concentration of abdominal adiposity could also indirectly increase the likelihood of low-back pain because it leads to the increased production of proinflammatory substances and is associated with dyslipidemia, which results in increased levels of circulating **triglycerides** and **low-density lipoprotein (LDL).** These factors play a major role in the development of **atherosclerosis** (the buildup of plaque in the arteries) in obese individuals (Howard, Ruotolo, & Robbins, 2003). Atherosclerosis could limit the amount of blood distributed to the spine and cause malnutrition of the disc cells (Korkiakoski et al., 2009), which may contribute to disc degeneration. People with severe disc degeneration are more likely to have low-back pain (Cheung et al., 2009). These findings strengthen the argument for weight loss (especially the reduction of abdominal adiposity) in obese individuals as a treatment for low-back pain, because doing so can improve blood lipid profiles, allowing proper nourishment of the discs, and decrease the mechanical strain on the low back. Additionally, strengthening the muscles of the trunk and performing regular **aerobic** endurance exercise are crucial for improving spine health.

Lower-extremity Musculoskeletal Pain

Extra body weight places added stress on the joints, impacts movement, affects gait, and increases foot pressure. In a study investigating forces in the lower extremities, compared to normal-weight individuals (BMI = 24.3 ± 3.0 kg/m^2), obese individuals exhibited higher plantar pressure, especially under the longitudinal arch and on the metatarsal heads, both while standing and walking (Hills et al., 2001). This pressure can contribute to **plantar fasciitis.** In fact, obese individuals are five to six times more likely to have plantar fasciitis than individuals with a normal BMI (18.5 to 25 kg/m^2) (Messier, 2008).

The knee joints in overweight and obese individuals are particularly vulnerable to osteoarthritis and show a greater progression of deterioration from the disease than do the knees of normal-weight individuals. Each excess pound of body weight puts an additional 4-pound stress on the knee (Messier et al., 2005). This additional joint stress represents a viable pathway for the pathogenesis and progression of knee osteoarthritis. Furthermore, the proinflammatory chemicals released by fat cells can also get into the joints and degrade **cartilage** (Messier, 2008).

Due to the pain and disability associated with lower-extremity disorders (e.g., plantar fasciitis and knee osteoarthritis), physical activity can be uncomfortable, which leads to **sedentary** behavior. These factors can cause a vicious cycle, as inactivity can result in even more weight gain. Taking precautions to protect affected, painful joints in overweight and obese clientele will contribute to increased participation in, and **adherence** to, physical activity.

Providing ways for clients with high BMIs to remain active is crucial, not only for cardiometabolic health, but also for quality of life. Weight loss and exercise can improve function and reduce the pain from osteoarthritis. Messier et al. (2005) found that a 5% reduction in body weight, combined with a moderate exercise program (such as walking 30 minutes a day, five days a week), results in a 24% increase in function and a 30% decrease in osteoarthritic knee pain over an 18-month period. For example, an obese client who weighs 250 pounds (114 kg) needs to lose only 12.5 pounds (5.7 kg) to experience these benefits. Conversely, weight gain of approximately 11 pounds (5.0 kg) over a 10-year period has been associated with a 50% increase in the likelihood of developing knee osteoarthritis (Felson et al., 1992).

Impact of Overweight/Obesity on Walking

Changes in lower-extremity musculoskeletal function, such as those described in the previous section, can affect an obese person's gait. Specifically, researchers (DeVita & Hortobágyi, 2003; Messier, 1994; Spyropoulos et al., 1991) report that some overweight and obese individuals have been shown to walk with:

- A shorter step length
- Lower cadence and velocity
- A decreased duration of the single-support phase
- An increased duration of the double-support phase
- Reduced range of motion at the knee and ankle

It is unclear whether these changes are directly related to increases in body weight or if they are an adaptation to reduce pain in the presence of osteoarthritis or to increase dynamic postural stability. Regardless of the causes of abnormal gait observed in obese individuals, these musculoskeletal adaptations should be taken into account when designing exercise programs for this group of clients.

One way to offer joint protection for obese clients who are starting a walking program is to be mindful of the speed at which they begin their training. In their study on the effects of obesity on the **biomechanics** of walking at different speeds, Browning and Kram (2007) found that walking slower reduced **ground reaction forces** and may be an appropriate risk-lowering strategy for obese adults who wish to walk for exercise. When obese subjects walked at 2.2 versus 3.3 miles per hour (mph) [1.0 versus 1.5 meters per second (m/s)], the peak **sagittal plane** forces at the knee were 45% less. Thus, even if an obese client's self-selected walking speed approximates 3.0 mph (1.4 m/s), it might be protective of the lower-extremity joints to recommend that he or she begins walking at a pace closer to 2.0 mph (0.9 m/s), at least initially until a 5% reduction in body weight is achieved.

Impact of Overweight/Obesity on Cycling

While walking may be an appropriate modality to facilitate weight loss, the pain or discomfort associated with it—even at slow cadences—may not be tolerated by some overweight or obese individuals. Consequently, cycling has been used as a nonweightbearing locomotor activity to promote increased **cardiorespiratory endurance** and caloric expenditure. Research on the biomechanical aspects of cycling in the obese population is surprisingly scarce (Nantel, Mathieu, & Prince, 2010). However, an important physiological consideration is the fact that obese individuals show a higher **oxygen consumption ($\dot{V}O_2$)** for a given cycling intensity when compared to normal-weight individuals (Ofir et al., 2007). In fact, it has been shown that obese individuals expend about 33% more energy than normal-weight subjects during cycling without any external resistance (i.e., zero resistance on the pedal provided by the bike) at 60 revolutions per minute (rpm), which a is a common cycling speed used in clinical settings for physical tests (Anton-Kuchly, Roger, & Varene, 1984). These findings clearly demonstrate that although cycling is a nonweightbearing activity, the support offered by the bike does not negate all of the difficulty associated with excess body weight. For exercise programming purposes, it is important not to overlook the fact that cycling without external resistance (e.g., at the lowest setting on the bike) can be sufficiently challenging for some obese people.

Another consideration before introducing cycling into an obese person's exercise program is the evidence reported on subject test termination during cycle ergometer assessments in the obese population. Hulens and colleagues (2001) found that reasons to terminate a maximal fitness test on a cycle ergometer differed according to body weight status. Compared to normal-weight subjects, obese participants reported that they terminated the exercise test far more often due to musculoskeletal pain than because of leg fatigue. Thus, musculoskeletal pain is still an important factor to consider for obese clients during cycling, and especially during fitness assessments on a cycle ergometer.

THINK IT THROUGH

How would you help obese individuals deal with the "discomforts" of exercise (e.g., arthritic pain, breathlessness, experience of excess body heat, and intimidation of being in the gym environment)?

EXPAND YOUR KNOWLEDGE

Obesity Does Not Protect Against Osteoporosis

Until recently, there has been a general consensus that being obese protected women against bone loss. It was thought that carrying extra body weight stimulated the skeleton to produce more bone minerals to support the structural needs of the obese individual. However, a study by Bredella and colleagues (2010) challenged this concept when they found that having too much internal abdominal fat may have a damaging effect on bone health. The researchers investigated abdominal subcutaneous, visceral, and total fat, as well as bone marrow fat and **bone mineral density,** in 50 premenopausal women with a mean BMI of 30 kg/m^2. The results revealed that women with more visceral fat had increased bone marrow fat and decreased bone mineral density. There was no significant correlation between either subcutaneous fat or total fat and bone marrow fat or bone mineral density. Consequently, the authors concluded that having excess visceral fat is more detrimental to bone health than having more superficial fat or fat around the hips.

Evidence from another study that examined complementary investigations in mice and women suggest that extreme obesity in postmenopausal women may be associated with reduced bone mineral density (Núñez et al., 2007). The authors concluded that extreme obesity (BMI > 40 kg/m^2) may increase the risk for osteoporosis. Evidence from animal studies suggest that the dramatically elevated levels of the hormone **leptin,** common in extremely obese individuals, may be associated with impaired bone formation and increased fracture risk (Cock & Auwerx, 2003). These studies suggest that leptin, which is produced primarily by fat cells, may play a role in osteoporosis, and that obese women with high leptin levels may have lower bone mass than overweight and normal-weight women.

Given the worldwide obesity epidemic, and in particular the rising number of obese adult women, the allied healthcare community must be aware of the significant and interrelated public health issues of obesity and osteoporosis. Health and fitness professionals should make it a point to seek out future research in this area as it becomes available.

ACE Integrated Fitness Training® Model Overview

Fitness professionals, including health coaches, are seeing an influx of clientele with an increasingly long list of special needs. What was once a relatively simplistic approach to programming for health-related fitness has become a seemingly complicated process that includes a myriad of training modalities, equipment, and differing schools of thought. The process of learning these new exercise-programming methods and the science behind them seems relatively easy when each is considered individually. It is when determining which training method, or methods, would be most appropriate for each client that the full weight of these rapid advances is felt, often leaving the health coach confused about where to begin and how to progress the client's program (Table 16-1). Both novice and veteran health coaches are well aware of the positive benefits exercise can yield in improving health, fitness, mood, weight management, stress management, and other health-related parameters. The *2008 Physical Activity Guidelines for Americans* reinforce these positive benefits by acknowledging that regular exercise is a critical component of good health and that individuals can reduce their risk of developing chronic disease by staying physically active and participating in structured exercise on a regular basis (U.S. Department of Health & Human Services, 2008). The guidelines specifically state that regular exercise will help prevent many common diseases, such as type 2 diabetes, coronary artery disease, high blood pressure, and the health risks associated with obesity.

Table 16-1

Traditional Physiological Training Parameters versus New Physiological Training Parameters

Traditional Training Parameters	New Training Parameters
• Cardiorespiratory (aerobic) fitness • Muscular endurance • Muscular strength • Flexibility	Traditional Training Parameters plus: • Postural (kinetic chain) stability • Kinetic chain mobility • Movement efficiency • Core conditioning • Balance • Metabolic markers (ventilatory thresholds) • Agility, coordination, and reactivity • Speed and power

The *2008 Physical Activity Guidelines for Americans* suggest that adults should participate in structured cardiorespiratory-related physical activity at a moderate intensity for at least 150 minutes per week or a vigorous intensity for at least 75 minutes per week to experience the health benefits of exercise. In addition, it is recommended that most adults incorporate muscle-strengthening activities at least two days a week. While this document endorses exercise as a means to achieve good health, it does not provide specific instructions for how to exercise.

A summary of general exercise programming guidelines for apparently healthy adults can be found in Table 16-2. These guidelines are based on sound research for providing safe and effective exercise for apparently healthy adults, but they are so broad that health coaches require additional information on how to appropriately implement them for each individual client.

In addition, there are exercise guidelines for many specific groups, including youth, older adults, pre- and postnatal women, and people who have hypertension, dyslipidemia, osteoporosis, and a variety of other special needs. These guidelines are based on medical and scientific research, are published by the governing body of practitioners for each respective special-needs group, and provide specific exercise guidelines to help these individuals improve their health and quality of life. So how does a health coach pull it all together? How

Table 16-2

General Exercise Recommendations for Healthy Adults

Training Component	Frequency (days per week)	Intensity	Time (Duration) or Repetitions	Type (Activity)
Cardiorespiratory	>5 or >3 or 3–5	Moderate (40% to <60% $\dot{V}O_2R$/HRR) Vigorous (≥60% $\dot{V}O_2R$/HRR) Combination of moderate and vigorous	>30 minutes* 20–25 minutes* 20–30 minutes*	Aerobic (cardiovascular endurance) activities and weightbearing exercise
Resistance	2–3	60–80% of 1 RM or RPE = 5 to 6 (0–10 scale) for older adults	2–4 sets of 8–25 repetitions (e.g., 8–12, 10–15, 15–25; depending upon goal)	8–10 exercises that include all major muscle groups (full-body or split routine); Muscular strength and endurance, calisthenics, balance, and agility exercise
Flexibility	>2–3	Stretch to the limits of discomfort within the ROM, to the point of mild tightness without discomfort	>4 repetitions per muscle group Static: 15–60 seconds; PNF: hold 6 seconds, then a 10–30 second assisted stretch	All major muscle tendon groups Static, PNF, or dynamic (ballistic may be fine for individuals who participate in ballistic activities)

*Continuous exercise or intermittent exercise in bouts of at least 10 minutes in duration to accumulate the minimum recommendation for the given intensity

Note: $\dot{V}O_2R$ = $\dot{V}O_2$ reserve; HRR = Heart-rate reserve; 1 RM = One-repetition maximum; RPE = Ratings of perceived exertion; ROM = Range of motion; PNF = Proprioceptive neuromuscular facilitation

Source: American College of Sports Medicine (2010). *ACMS's Guidelines for Exercise Testing and Prescription* (8th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.

does a novice or even an experienced health coach know which assessments to perform, when to perform them, which guidelines are most important, when to address foundational imbalances in posture or movement, and how to progress or modify a program based on observed and reported feedback?

To address these questions and more, the American Council on Exercise developed the ACE Integrated Fitness Training (ACE IFT®) Model to provide fitness professionals with a systematic and comprehensive approach to exercise programming that integrates assessments and programming to facilitate behavioral change, while also improving posture, movement, **flexibility**, **balance**, core function, cardiorespiratory fitness, **muscular endurance**, and **muscular strength.**

Health–Fitness–Performance Continuum

The health–fitness–performance continuum is based on the premise that exercise programs should follow a **progression** that first improves health, then develops and advances fitness, and finally enhances performance (Figure 16-1). Each client will have different needs based on his or her personal health, fitness, and goals. Therefore, each client will start his or her exercise

Figure 16-1
The health–fitness–performance continuum

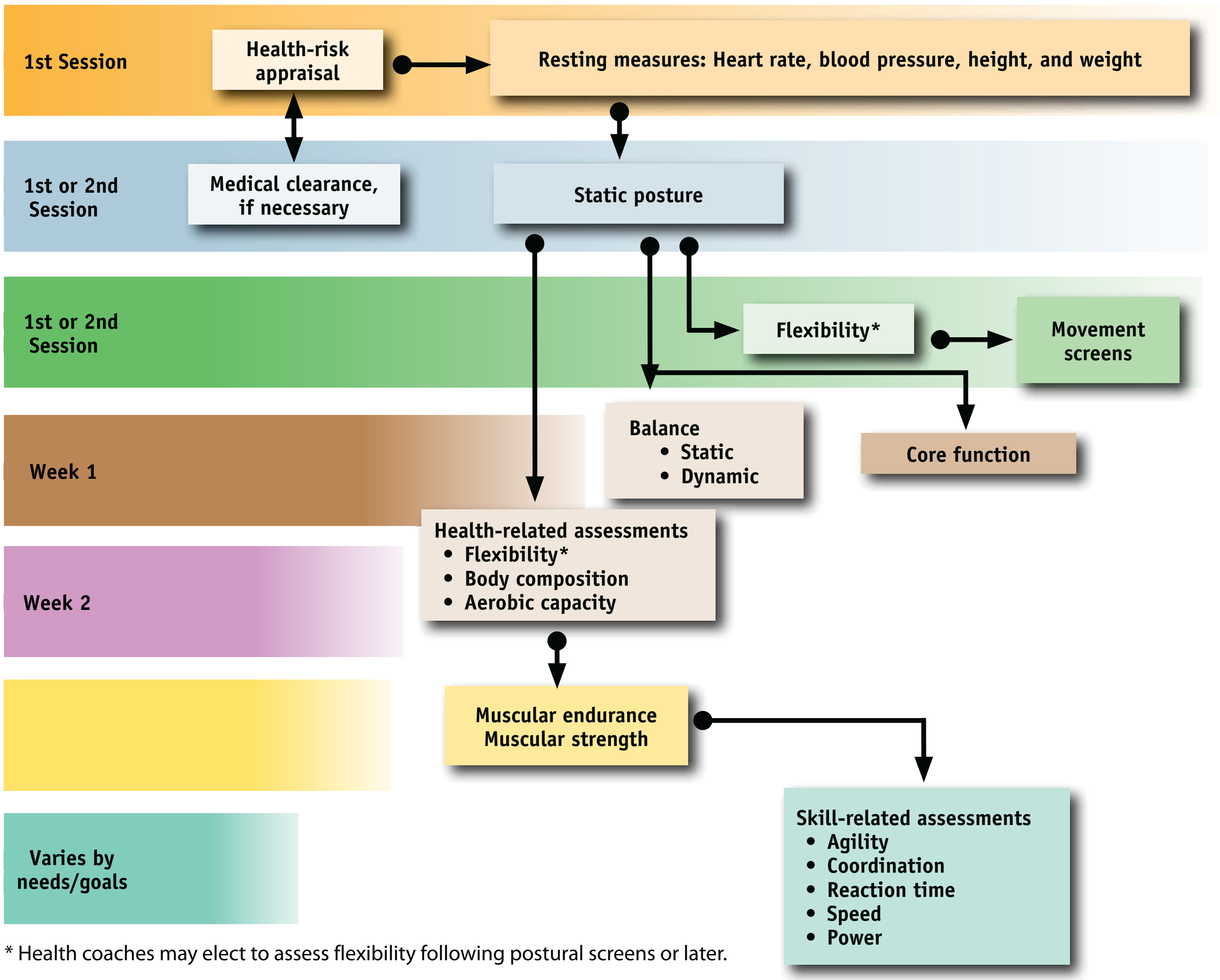
program at a unique point along the continuum. The first component of this continuum is exercise for improved health, which serves as the foundation of every exercise program, even if the client's ultimate goal is to achieve optimum athletic performance for a specific competition. For a client who has been sedentary, improved health should be a primary program goal. For clients who have progressed into the fitness or performance domains, their comprehensive training programs should still feature components that maintain or help improve health as well as address their specific fitness or athletic goals.

Components of the ACE Integrated Fitness Training Model

The foundation of the ACE IFT Model is built upon **rapport.** Successful health coaches consistently demonstrate excellent communication skills and teaching techniques, while understanding the psychological, emotional, and physiological needs and concerns of their clients. Building rapport is a process that promotes open communication, develops trust, and fosters the client's desire to participate in an exercise program. Rapport should be developed early through open communication and initial positive experiences with exercise, and then enhanced through behavioral strategies that help build long-term adherence.

After establishing an initial rapport, the health coach should collect health-history information to determine if the client has any **contraindications** or requires a physician's evaluation prior to exercise. The collection of health-history information and other pre-exercise paperwork is covered in Chapter 10, while health-related physiological measurements such as **resting heart rate** and blood pressure are covered in Chapter 12. The ACE IFT Model includes functional and physiological assessments that can be performed at specific phases to provide key information for exercise programming in that phase. Some assessments, such as those that focus on functional movement, balance, and range of motion, may be conducted within the first few sessions with a new client, while other assessments might not be conducted until the client has progressed from one phase to another. Ideally, the health coach should utilize a sequential approach to conducting client assessments that begins with reviewing the client's health history; discussing desires, preferences, and general goals; completing a needs assessment; and then determining which assessments are relevant and the timelines in which to conduct them (Figure 16-2). A selection of assessment protocols included in the ACE IFT Model is covered in Chapter 11.

The ACE IFT Model is a comprehensive system for exercise programming that pulls together the multifaceted training parameters required to be a successful fitness professional. It organizes the latest exercise science research into a logical system that



* Health coaches may elect to assess flexibility following postural screens or later.

Figure 16-2
Sample assessment sequencing for the general client

Note: Refer to the *ACE Personal Trainer Manual* for information on those assessments not covered in this text.

helps health coaches determine appropriate assessments, exercises, and progressions for clients based on their unique health, fitness, needs, and goals. The ACE IFT Model has two principal training components:

- Functional movement and resistance training
- Cardiorespiratory training

Each of these components is composed of four phases that provide health coaches with strategies to determine and implement the most appropriate assessments and exercise programs for clients at all levels of fitness. Each phase has a title that is descriptive of the principal training focus during that specific phase (Table 16-3). Rapport is the foundation for success during all phases of training, whether a health coach is working with a highly motivated fitness enthusiast or a sedentary adult looking to adopt more healthful habits.

The four training phases run parallel to the health–fitness–performance training continuum that was presented in Figure 16-1 (Figure 16-3). In phase 1, the primary focus is on improving health by correcting imbalances through training to improve joint stability and mobility

Table 16-3

ACE Integrated Fitness Training Components and Phases

Training Component	Phase 1	Phase 2	Phase 3	Phase 4
Functional Movement & Resistance Training	Stability and Mobility Training	Movement Training	Load Training	Performance Training
Cardiorespiratory Training	Aerobic-base Training	Aerobic-efficiency Training	Anaerobic-endurance Training	Anaerobic-power Training

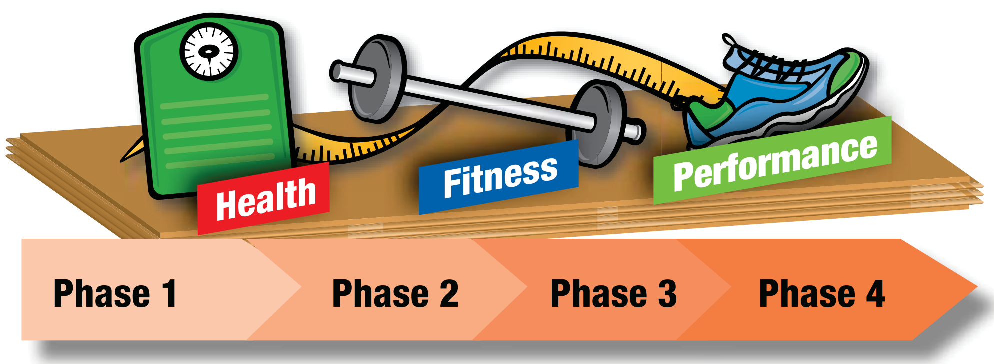


Figure 16-3
ACE IFT Model phases and the health–fitness–performance continuum

prior to training movement patterns and building an aerobic base to improve parameters of cardiorespiratory health. The primary focus of phase 2 is to progress clients toward improved fitness by introducing aerobic intervals to improve aerobic efficiency and training movement patterns prior to loading the movements. In phase 3, clients progress to higher levels of fitness through load training and the development of **anaerobic** endurance, as cardiorespiratory programming in this phase moves into the performance area of the health–fitness–performance continuum. Phase 4 is focused entirely on improving performance through training for **muscular power,** speed, agility, reactivity, and anaerobic power. Each client will progress from one phase to the next according to his or her unique needs, goals, and available time to commit to training. Many clients will be at different phases of the two training components based on their current health and fitness, and only clients with performance-oriented goals will reach phase 4.

Applications for Overweight/Obese Individuals

For the purposes of this chapter, the information presented on specific exercise programming will focus primarily on the overweight/obese population. For an in-depth discussion on using the ACE IFT Model for exercise programming and progressions for a wide variety of individuals, refer to the *ACE Personal Trainer Manual*.

There is a general consensus among the U. S. Department of Agriculture, ACSM, and International Association for the Study of Obesity that a weekly energy expenditure of ≥2,000 calories per week, which equates to approximately 60–90 minutes per day of moderate-intensity physical activity, may be required for long-term weight loss (U.S. Department of Agriculture, 2010; ACSM, 2009; Sarris et al., 2003). The basis for these recommendations is also supported by the National Weight Control Registry (NWCR), a cohort of approximately 10,000 "successful losers" who have lost an average of 66 pounds and maintained this loss for approximately 5.5 years. The NWCR found that while dietary control was an important factor in the maintenance of weight loss, one of the most significant findings was that successful losers maintained consistently high daily physical-activity levels. In fact, 90% of the NCWR subjects exercise, on average, about 1 hour per day and 62% report watching fewer than 10 hours of television per week (NCWR, 2012).

The amount of physical activity suggested for weight loss and prevention of weight regain in overweight and obese individuals is clearly greater than that recommended for public health improvement as described in the *2008 Physical Activity Guidelines for Americans*. For improved health, a minimum of 150 minutes of physical activity per week, or 30 minutes of physical activity on most days of the week is advised (U.S. Department of Health & Human Services, 2008; Haskell et al., 2007). For obese individuals, a progression to approximately 250 to 300 minutes of physical activity per week, or 50 to 60 minutes five days each week, may be necessary for long-term weight loss success. In some cases, 60 to 90 minutes of daily exercise may be required (Zoeller, 2007).

The primary mode of initial activity to facilitate weight loss is aerobic, or endurance, exercise. Aerobic conditioning maximizes caloric expenditure in individuals who have obesity or are new to exercise, and reduces the risk of chronic disease associated with obesity (e.g., CVD, type 2 diabetes, and the metabolic syndrome). The ACE IFT Model can be used to adjust exercise selection, intensity, and duration to fit the special needs of overweight and obese clients. Many of these individuals may never progress beyond the aerobic-efficiency phase of cardiorespiratory training (phase 2), and many of them will never progress beyond the loading phase of functional movement and resistance training (phase 3). The most important goal with all clients is to provide them with initial positive experiences that promote adherence through achievable initial successes. Transitioning an obese client into the **action** stage and then on to the **maintenance** stage of change (see Chapter 3) will have a significant impact on that client's health and overall quality of life, and may even have a positive impact on the client's state of physical and mental fitness.

Using Assessment Results to Guide Exercise Programming

After the initial interview and physical assessments have been administered, the health coach can develop a plan of action for the client based on the unique characteristics of the individual and his or her program goals. Keep in mind that fitness assessments may be administered throughout the client's program and may not need to be completed before the client begins his or her first exercise session, especially if performing assessments is contraindicated due to musculoskeletal injury or if the client feels uncomfortable with being measured and compared to standardized norms. A program beginning with simple stabilization exercises, walking, and stretching is an appropriate first-session approach for novice exercisers who are overweight or obese and who feel intimidated by the assessment process. With the exception of a health-history screening, a client does not necessarily have to be assessed immediately upon beginning a program. For early success and to promote feelings of accomplishment, light exercise intensity combined with a tolerable exercise duration works well as an initial plan for introducing physical activity to a deconditioned client. This approach can be incorporated on the first day of engagement with a new client.

When the client and health coach together decide that performing physical-fitness assessments is a good course of action, the information obtained from the process can be valuable to help show progress. The following sections describe how, in general, evaluation data from assessments can be used by the health coach to guide the client's exercise programming.

Cardiorespiratory Fitness

Once the client's cardiorespiratory fitness level has been established and any cardiovascular health risks have been ruled out (see pages 324–337), an appropriate fitness program can be initiated. For novice exercisers, improving on cardiovascular fitness should be addressed in a twofold manner. The first goal is to gradually increase exercise duration. This allows the body to adapt to the new demands of exercise and respond accordingly to the physiological stress of training (e.g., increase in **capillary** density, increase in **mitochondrial** size/number, and enhanced ability to remove **lactic acid**). Initially, training volume can be increased by 10 to 20% per week, until the desired training volume is achieved.

For those who already have a solid cardiorespiratory training base, the second phase of training focuses on increasing exercise intensity, in an effort to increase **$\dot{V}O_2$max.** As long as there are no contraindications to higher-intensity training, it is appropriate to incorporate moderate-intensity steady-state training as well as **interval training.** Health coaches should keep in mind that even among the obese population, physical fitness exists in a continuum, meaning that individuals have different abilities and some are able to tolerate more exertion than others. For clients who are not capable of achieving the minimum recommendation of 150 minutes of weekly moderate-intensity activity (i.e., 30 minutes of endurance exercise, five days per week), reaching this level of activity should be the primary goal during the initial conditioning stage. Overweight and obese adults may find that accumulating 30 minutes of activity in multiple daily bouts of at least 10 minutes in duration is preferable to exerting themselves for longer time periods. This approach is appropriate, at least in the beginning of the training program, as it may be better tolerated and is likely to promote positive feelings associated with successfully accomplishing a healthy task (ACSM, 2010).

Stability and Mobility

A static postural assessment is an excellent test for observing a client's joints and how they relate to each other, and for viewing how those joints maintain their positions against gravity in a relaxed, standing position (see pages 339–341). Individuals who exhibit good posture generally demonstrate an appropriate relationship between stability and mobility throughout the kinetic chain. On the other hand, individuals who exhibit poor posture typically lack the mobility required for normal joint movement, the stability to maintain good posture, or both.

Observing active movement is an effective method to determine the contribution that muscle imbalances and poor posture have on neural control, and also helps identify movement compensations (Whiting & Rugg, 2006; Sahrmann, 2002). Functional movement assessments, such as the body-weight squat test, front plank test, and overhead reach test (see pages 348–352), help health coaches view compensations that occur during a client's movement. If altered movement patterns are present, it is usually indicative of some form of adjusted neural action, commonly referred to as "faulty neural control," which normally manifests itself out of muscle tightness or an imbalance between muscles acting at the joint.

Movement can essentially be broken down and described by five primary movements that people perform during many daily activities (Cook, 2003):

- Bending/raising and lifting/lowering movements (e.g., squatting)
- Single-leg movements (seen in walking and climbing stairs)
- Upper-body pushing movements and resultant movement
- Upper-body pulling movements and resultant movement
- Rotational movements

When mobility is compromised, the following movement compensations typically occur:

- The joint will seek to achieve the desired ROM by incorporating movement into another plane. For example, when a client walks, which requires hip **extension** (sagittal plane movement), and lacks flexibility in the hip flexors, it is possible to see excess **rotation** in the lumbar spine (**transverse plane** movement), thereby producing a compensated movement pattern.
- Adjacent, more stable joints may need to compromise some degree of stability to facilitate the level of mobility needed. For example, if a client exhibits increased **kyphosis** and attempts to extend the thoracic spine, an increase in lumbar lordosis often occurs as a compensation for the lack of thoracic mobility.

A lack of mobility can be attributed to numerous factors, including reduced levels of physical activity, and increased actions that promote muscle imbalance (e.g., repetitive movements, habitually poor posture, side-dominance, poor exercise technique, and imbalanced strength-training programs) (Kendall et al., 2005). This loss of mobility leads to compensations in movement and potential losses of stability at subsequent joints.

It is important to remember that while all joints demonstrate varying levels of stability and mobility, they tend to favor one over the other, depending on their function within the body (Figure 16-4) (Cook & Jones, 2007a; 2007b). For example, while the lumbar spine demonstrates some mobility (approximately 13 degrees of rotation), it is generally stable, protecting the low back from injury. On the other hand, the thoracic spine is designed to be more mobile to facilitate a variety of movements in the upper extremity. The scapulothoracic joint is a more stable union formed by a collection of muscles attaching the scapulae to the ribcage. This arrangement allows the scapulothoracic joint to provide a solid platform for pulling and pushing movements at the shoulder while simultaneously allowing it to tolerate the reactive forces transferred to the body during these movements. The foot is unique, as its level of stability varies during the gait cycle. The foot and ankle joints are more stable when weightbearing, especially when the foot is flat, and more mobile during the swing phase of the gait cycle, as the ankle moves from **plantarflexion** to **dorsiflexion** and the foot moves from **eversion** to **inversion** as it transitions from pushing off the ground (toe off), moving forward to prepare for heel strike. These stability-mobility relationships of the joints along the kinetic chain should be kept in mind when designing any type of exercise program.

For clients who demonstrate muscle imbalances during a static postural assessment and noticeable compensations during movement screens, their first training objective should be to reestablish appropriate levels of stability and mobility of the joints within the body. This

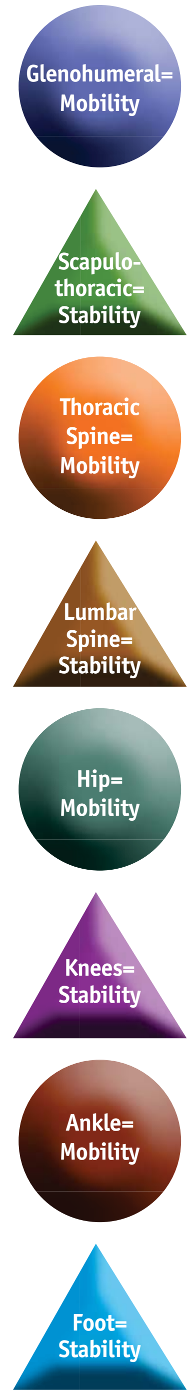
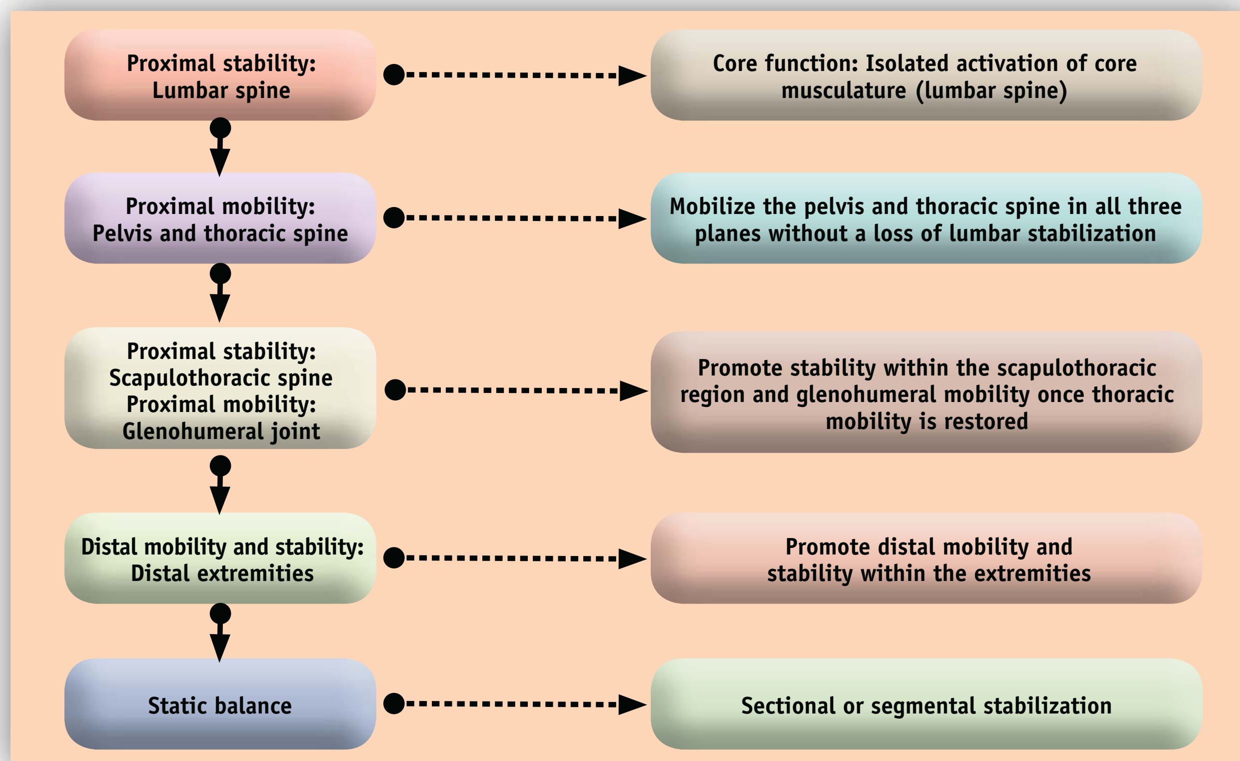


Figure 16-4
Mobility and stability of the kinetic chain

process begins by targeting an important **proximal** region of the body, the lumbar spine, which encompasses the body's **center of mass (COM),** and the core (i.e., the muscles and joints of the trunk, **shoulder girdle,** and hip girdle). As this region is primarily stable, programming should begin by first promoting stability of the lumbar region through the action and function of the core. Once an individual demonstrates the ability to stabilize this region, the program should then progress to the more **distal** segments. Adjacent to the lumbar spine are the hips and thoracic spine, both of which are primarily mobile. As thoracic spine mobility is restored, the program can target stability of the scapulothoracic region. Finally, once stability and mobility of the lumbo-pelvic, thoracic, and shoulder regions have been established, the program can then shift to enhancing mobility and stability of the distal extremities. Attempting to improve mobility within distal joints without developing more proximal stability only serves to compromise any existing stability within these segments. When a joint lacks stability, many of the muscles that normally mobilize that joint may need to alter their true functions to assist in providing stability. For example, if an individual lacks stability in the scapulothoracic joint, the deltoids, which are normally responsible for many **glenohumeral** movements, may need to compromise some of their force-generating capacity and assist in stabilizing glenohumeral movement (Cook & Jones, 2007a). This altered deltoid function decreases force output and may increase the potential for dysfunctional movement and injury.

Figure 16-5 illustrates a programming sequence to promote stability and mobility. It adheres to the basic principle that proximal stability facilitates distal mobility. For each of the five sections of this figure, several exercise examples are provided in Chapter 17 to help health coaches plan and implement programs. Health coaches should feel free to apply these same principles using different exercises and different programs individualized to a

Figure 16-5
Programming components of the stability and mobility training phase



client's specific needs. Based on the postural and movement screen observations, health coaches will identify potential problem areas of the body that need attention (i.e., improvements in stability or mobility). For example, if a client demonstrates a lack of trunk stability during the front plank test (see page 350), a lack of core function should be suspected. Likewise, if a client exhibits an exaggerated anterior pelvic tilt during a static postural assessment due to tight hip flexors, the health coach will need to address a lack of hip flexor mobility.

Flexibility

Static posture assessments and movement screens, such as the body-weight squat test, front plank, and overhead reach (see Chapter 11), can reveal muscles that have become adaptively shortened. If inadequate ROM is found at specific joints or if discrepancies are observed between the right and left sides of the body, a program of focused stretching for the areas in question should be initiated.

The following are some common stretching techniques and general guidelines for their use:

- **Myofascial release:** Clients perform small, continuous, back-and-forth movements (on a foam roller), covering an area of 2 to 6 inches (5 to 15 cm) over the tender region for 30 to 60 seconds (Cook & Jones, 2007b; Barnes, 1999). See page 459 for more information on myofascial release.
  - ✓ Myofascial release should precede static stretching because it realigns the elastic muscle fibers from a bundled position (called a knot or adhesion) into a straighter alignment with the muscle and **fascia,** and resets the proprioceptive mechanisms of the soft tissue (Barnes, 1999). Myofascial release helps reduce hypertonicity (tightness) within the underlying muscles.
- **Static stretching:** Static stretches involve moving a joint to where the targeted muscles reach a point of tension at the end point of the movement. Ideally, clients should perform a minimum of four repetitions on each stretching exercise, holding each repetition for 15 to 60 seconds (Figure 16-6) (ACSM, 2010). However, if following the full recommendation of completing four repetitions is perceived as too time consuming for some clients, even performing just one set of stretching is beneficial.
- **Proprioceptive neuromuscular facilitation (PNF):** PNF stretching involves taking a joint through a movement until the targeted muscles reach a point of tension, holding the stretch for 10 seconds, and then having the client perform an **isometric** contraction of the **agonist** for a minimum of six seconds, followed by a 10- to 30-second assisted or passive static stretch (Figure 16-7) (ACSM, 2010). This type of hold-relax PNF stretch can be performed several times.
- **Active isolated stretching (AIS):** This stretching technique involves moving the joint from the starting position through the motion to the end point, holding for no more than two seconds, and then returning to the starting position to immediately repeat the stretching motion. Clients can perform one or two sets of five to 10 repetitions at a controlled tempo, holding the end range of motion for one to two seconds (Figure 16-8) (Alter, 2004).
- **Dynamic** and **ballistic stretching:** Dynamic stretches prepare the body for the upcoming workout or sport by mimicking movement patterns that will be performed during the actual workout. Dynamic stretches are most effective as part of the warm-up. Ballistic

Figure 16-6
Passive static stretch of the hamstrings

Figure 16-7
Hold-relax hamstrings stretch

Figure 16-8
Active isolated stretching

stretches incorporate small bouncing movements as part of the dynamic pre-training warm-up. Ballistic stretches usually trigger the stretch reflex, potentially increasing the risk of injury and making them not widely advocated. Clients can perform one or two sets of 10 repetitions of dynamic stretching movements as part of the warm-up, or similar sets of ballistic stretches when appropriate (Cook, 2003).

Balance and Core Function

Given the importance of balance and the condition of the core musculature to fitness and overall quality of life, these baseline assessments should be collected to evaluate the need for comprehensive balance training and core conditioning during the early stages of a conditioning program. Health coaches should feel comfortable evaluating the basic level of **static balance** that a client exhibits by using the sharpened Romberg test or the stork-stand test (see page 342–343).

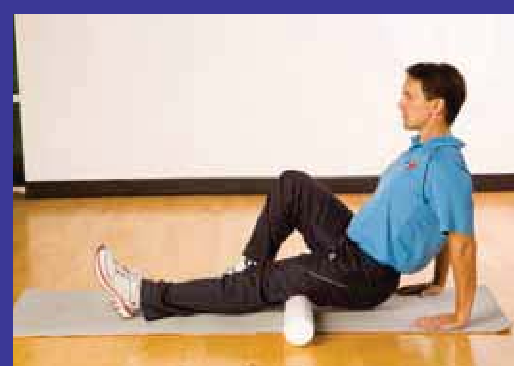
EXPAND YOUR KNOWLEDGE

Understanding Myofascial Release

Understanding the concept behind myofascial release requires an understanding of the fascial system itself. Fascia is a densely woven, specialized system of **connective tissue** that covers and unites all of the body's compartments. The result is a system where each part is connected to the other parts through this web of tissue. Essentially, the purpose of the fascia is to surround and support the bodily structures, which provides stability as well as a cohesive direction for the line of pull of muscle groups. For example, the fascia surrounding the quadriceps keeps this muscle group contained in the anterior compartment of the thigh (stability) and orients the muscle fibers in a vertical direction so that the line of pull is more effective at extending the knee. In a normal healthy state, fascia has a relaxed and wavy configuration. It has the ability to stretch and move without restriction. However, with physical trauma, scarring, or inflammation, fascia loses its pliability. It becomes tight, restricted, and a potential source of pain. **Acute** injuries, habitual poor posture over time, and repetitive stress injuries can be damaging to the fascia. As a result, the damaged fascia can exert excessive pressure on the underlying structures, producing pain or restriction of motion, which in turn may induce adaptive shortening of the muscle tissue associated with the fascia.

Figure 16-9
Myofascial release for gluteals/external rotators

Myofascial release for the quadriceps



Myofascial release for the hamstrings

Myofascial release is a technique that applies pressure to tight, restricted areas of fascia and underlying muscle in an attempt to relieve tension and improve flexibility. It is thought that applying direct sustained pressure to a tight area can inhibit the tension in a muscle by stimulating the **Golgi tendon organ (GTO)** to bring about **autogenic inhibition.** Tender areas of soft tissue (also called trigger points) can be diminished through the application of pressure (myofascial release) followed by static stretching of the tight area.

The practical application of myofascial release in the fitness setting is commonly done through the use of a foam roller, where the client controls his or her own intensity and duration of pressure. A common technique is to instruct clients to perform small, continuous, back-and-forth movements on a foam roller, covering an area of 2 to 6 inches (5 to 15 cm) over the tender region for 30 to 60 seconds (Figure 16-9). Because exerting pressure on an already tender area requires a certain level of pain tolerance, the intensity of the application of pressure determines the duration for which the client can withstand the discomfort.

For example, a client with a high pain tolerance can position his or her body on the foam roller directly over a tender area and hold the applied pressure for 30 seconds. On the other hand, a client with low pain tolerance can position his or her body near the focal point of the tender area and hold the applied pressure for 60 seconds.

Ultimately, myofascial release realigns the elastic muscle and connective tissue fibers from a bundled position (called a knot or adhesion) into a straighter arrangement, and resets the proprioceptive mechanisms of the soft tissue, thus reducing hypertonicity within the underlying muscles.

Demonstrated deficiencies in core functional assessments, such as McGill's torso muscular endurance battery (see page 344), should be addressed during exercise programming as part of the foundational exercises for a client. The goal is to create ratios consistent with McGill's recommendations. Muscular endurance, more so than muscular strength or even ROM, has been shown to be an accurate predictor of back health (McGill, 2007). Low-back stabilization exercises have the most benefit when performed daily. When working with clients with low-back dysfunction, it is prudent to include daily stabilization exercises in their exercise plans.

Since most Americans will experience low-back pain at some point in their lives, a comprehensive fitness program should incorporate spinal stabilization exercises. **Core stability** should be a key element in any training program. If the core is not strong, the back may be compromised during a dumbbell shoulder press, creating excessive lumbar lordosis. The same break in position can happen during a squat or a bench press, thus creating excess stress on the lumbar spine. Improper alignment can create a whole host of problems for the lower back, ranging from herniated discs to sciatic pain. While clients' training objectives can vary from post-rehabilitation or prevention of low-back pain to optimizing health and fitness or maximizing athletic performance, all clients will benefit from exercises targeting core stability.

Muscular Fitness

Muscular-endurance testing assesses the ability of a specific muscle group, or groups, to perform repeated or sustained contractions to sufficiently invoke muscular fatigue. While most muscular-endurance tests are designed to measure the ability of a muscle group to maintain a single contraction or produce repeated contractions, the nature of some of the tests are so challenging that deconditioned individuals will fatigue almost immediately. In these cases, the exerciser has to develop a certain level of base strength before muscular-endurance testing can be accomplished properly. Because many overweight and obese individuals are novice exercisers, and as such are likely to be deconditioned, basic muscular-fitness testing for these individuals is enough of a challenge, making muscular-strength testing [such as **one-repetition maximum (1-RM)** testing] unnecessary.

The body-weight squat test (see page 348) and the front plank test (see page 350) are two basic muscular-fitness assessments that are appropriate for most individuals, as long as no injuries of the torso, back, or knees are present. The body-weight squat test assesses muscular fitness of the lower extremity when performing repetitions of a squat-to-stand movement. This test is only suitable for individuals who demonstrate proper form in executing a squat movement. The squat is also a valuable multijoint exercise that can be incorporated into a client's exercise program to develop strength in the lower extremity. If a client performs poorly on the body-weight squat test, it is a sign that he or she is lacking the muscular conditioning required to perform a crucial movement of daily living. In such cases, clients should be taught how to perform a squat correctly and then encouraged to incorporate squats frequently into their exercise programs.

If a client performs poorly on the front plank test, he or she lacks muscular fitness of the core. As such, the client should be given exercises that promote stability of the core and then progressed to performing movement patterns that incorporate distal segments of the body, all while still maintaining appropriate core stability.

Targeting Behaviors for Change in Overweight/Obese Individuals

The two main program components that have been shown to be successful for sustained weight-loss in overweight and obese individuals are modest reductions in energy intake and adequate levels of physical activity (ACSM, 2009; NHLBI, 1998). These two behaviors require a significant lifestyle change, which is perhaps the reason why losing weight and maintaining weight loss proves to be incredibly difficult for most people. Nonetheless, an overweight or obese client who is interested in losing weight must target changing eating and exercise behaviors in order to be successful in the long term.

Setting Goals for Metabolic Success

The following recommendations have been set forth by ACSM (2010) to guide health and fitness professionals in their attempts to assist overweight and obese individuals with weight loss.

- Adults with a BMI ≥25 kg/m^2 should be encouraged to engage in a weight-loss program.
- An initial weight-reduction goal of 5 to 10% of body weight should be targeted over a three- to six-month period.
- Following the initial weight-loss period, clients should be encouraged to enhance communication between their healthcare professionals, nutrition experts, and exercise professionals.
- Dietary changes resulting in a reduction of current caloric intake by 500 to 1,000 calories per day and a decrease in **dietary fat** to <30% of total caloric intake should be targeted.
- Increasing physical activity to a minimum of 150 minutes per week of moderate-intensity exercise should be encouraged.
- A progression to higher amounts of exercise (i.e., 200–300 minutes per week or ≥2,000 calories per week of physical activity) should be recommended to facilitate long-term weight control.
- Resistance training can be implemented as a supplement to the combination of aerobic endurance exercise and modest caloric reduction. While it is not the primary form of exercise recommended for weight loss, a program of regular resistance training can help to preserve muscle mass as a person loses body weight, which has positive implications for improving muscular fitness and **body composition** and helping maintain **resting metabolic rate (RMR).**
- Behavioral modification strategies should be incorporated to promote the adoption and maintenance of the lifestyle changes associated with long-term weight control.

Health coaches can use these recommendations to work together with their clients to set goals that are specific, measurable, attainable, relevant, and time-bound (i.e., **SMART goals**) (see Chapter 13). Furthermore, following up with clients regularly as they achieve short-term goals is a crucial part of maintaining contact with them and guiding them through their weight-loss achievements.

EXPAND YOUR KNOWLEDGE

Not Gaining Is Winning

An important concept that health coaches should consider while implementing weight-loss programs for obese clients is that primary prevention of obesity starts with maintenance of current weight, not weight reduction (ACSM, 2009). In other words, preventing the obese client from gaining any more weight, thus maintaining weight, can be viewed as a successful achievement, especially during the first few weeks of a weight-loss program. The stoppage of additional weight gain means that the behavioral changes the client is attempting to make are working to the extent that the client has stopped the metabolic processes associated with adding on more weight (i.e., caloric intake no longer exceeds caloric expenditure). Providing the client with this insight can be helpful if he or she becomes discouraged due to a lack of weight loss during the initial weeks of a behavior-change program.

Obesity and Weight Regain

Successful weight loss, especially for an obese individual, is a significant achievement and provides numerous health benefits as described earlier in this chapter. Once a weight-loss goal is achieved, clients should have a clearer understanding of the individual strategies that helped them reach their lower body weight. Unfortunately, weight regain remains problematic for those who have lost weight.

A meta-analysis of published research on formerly obese subjects suggests that inherent biological factors could explain the tendency for weight losers to regain weight. For example, it was found that formerly obese persons had a 3–5% lower mean relative RMR than normal-weight control subjects, and the difference could be explained by a low RMR being more frequent among the formerly obese subjects than among the normal-weight control subjects (Arstrup et al., 1999). The authors of the report concluded that the lower RMR among formerly obese subjects could be due to a genetic effect or to an adaptive response to weight loss that may increase the susceptibility of formerly obese persons to regain weight.

Research on obesity-prone rats suggests that lower RMR combined with a progressively increasing appetite appear to be the hallmark of the metabolic tendency to regain weight after weight loss. MacLean and colleagues (2004a) found that a persistent lower RMR explained 60% of the potential energy imbalance, while an elevated appetite explained 40% of weight regain in formerly obese rats. It is likely that these metabolic responses, may explain—at least in part—why sustained weight reduction is so challenging. Accordingly, weight regain after weight loss has been repeatedly shown in both rodents (Levin & Dunn-Meynell, 2004; MacLean et al., 2004b; Levin & Dunn-Meynell, 2002; Levin & Keesey, 1998) and humans (Votruba, Blanc, & Schoeller, 2002; Froidevaux et al., 1993).

Given that regaining lost weight is a likely challenge for clients after they have reached their weight-loss goals, health coaches can help their clients beat the odds by encouraging them to reinforce their commitment to exercise. Although metabolic factors appear to favor weight regain, participation in daily physical activity decreases the rate of weight regain (Chaput et al., 2008). Remember, the NWCR found that while dietary control was an important factor in the maintenance of weight loss, one of the most significant findings was that successful losers maintained consistently high daily physical-activity levels (see page 453).

Similar findings have been reported by Jakicic et al. (2008), who studied obese women randomly assigned to one of four groups based on physical activity energy expenditure (1,000 versus 2,000 kcal/week) and intensity (moderate versus vigorous) with a concomitant decrease in daily dietary energy intake (–1,200 to –1,500 kcal/day). Between the four groups, there was no difference in weight loss at six and 24 months. However, *post hoc* analyses showed that the subjects sustaining a loss of 10% or more of initial body weight at two years reported performing more physical activity (approximately 1,800 kcal/week or 275 min/week) compared to those sustaining a weight loss of less than 10% of initial body weight (who performed approximately 1,000 kcal/week or 170 min/week of physical activity).

While weight regain is a persistent challenge, especially for formerly obese individuals, it does not have to be a certainty. According to the available research, maintaining consistent and permanent high levels of moderate to vigorous daily physical activity seems to be the key for sustained weight loss (Chaput et al., 2008).

Summary

Given current obesity statistics, health coaches will most likely serve a high percentage of clientele who are overweight or obese. Obesity is associated with many other adverse health conditions, including CVD, type 2 diabetes, the metabolic syndrome, functional impairment, reduced quality of life, and greater mortality. Fortunately, when treatment is successful at producing even small amounts of weight loss, obese individuals experience many health benefits, including prevention of disease (especially type 2 diabetes). Health coaches can help their clients overcome obesity and its associated health problems by educating them about the importance of managing body weight by carefully manipulating energy balance, which is influenced by energy intake and energy expenditure. This can be achieved by giving clients the resources to make healthier choices when it comes to dietary intake and physical activity and exercise. Once weight-loss goals are reached, health coaches can play an important role in helping clients maintain their lower body weights by encouraging them to maintain a program of daily, moderate- to vigorous-intensity physical activity.

References

Allison, D.B. et al. (2008). Obesity as a disease: A white paper on evidence and arguments commissioned by the Council of The Obesity Society. *Obesity*, 16, 1161–1177.

Alter, M.J. (2004). *Science of Flexibility* (3rd ed.). Champaign, Ill.: Human Kinetics.

American College of Sports Medicine (2010). *ACSM's Guidelines for Exercise Testing and Prescription* (8th ed.). Philadelphia: Wolters Kluwer/ Lippincott Williams & Wilkins.

American College of Sports Medicine (2009). Position stand: Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine & Science in Sports & Exercise*, 41, 459–471.

Anton-Kuchly, B., Roger, P., & Varene, P. (1984). Determinants of increased energy cost of submaximal exercise in obese subjects. *Journal of Applied Physiology*, 56, 18–23.

Astrup, A. et al. (1999). Meta-analysis of resting metabolic rate in formerly obese subjects. *American Journal of Clinical Nutrition*, 69, 1117–1122.

Avenell, A. et al. (2004). Systematic review of the long-term effects and economic consequences of treatments for obesity and implications for health improvement. *Health Technology Assessment*, 21, 1–465.

Barnes, J.F. (1999). Myofascial release. In: Hammer, W.I. (Ed.) *Functional Soft Tissue Examination and Treatment by Manual Methods* (2nd ed). Gaithersburg, Md.: Aspen Publishers.

Bray, G.A. (2007). The missing link–lose weight, live longer. *New England Journal of Medicine*, 357, 818–820.

Bredella, M. et al. (2010). Detrimental effects of visceral obesity on bone health. Presentation at the 96th Scientific Assembly and Annual Meeting of the Radiological Society of North America, Code: SSJ17-05. November 30th.

Browning, R.C. & Kram, R. (2007). Effects of obesity on the biomechanics of walking at different speeds. *Medicine & Science in Sports & Exercise*, 39, 1632–1641.

Chaput, J. et al. (2008). Physical activity plays an important role in body-weight regulation. *Journal of Obesity*, 2011, Article ID 360257, 11 pages doi:10.1155/2011/360257.

Cheung, K.M. et al. (2009). Prevalence and pattern of lumbar magnetic resonance imaging changes in a population study of one thousand forty-three individuals. *Spine*, 34, 934–940.

Church, T.S. et al. (2002). Associations between cardiorespiratory fitness and C-reactive protein in men. *Arteriosclerosis, Thrombosis, & Vascular Biology*, 22, 1869–1876.

Cock, T. A. & Auwerx, J. (2003) Leptin: cutting the fat off the bone. *Lancet*, 362, 1572–1574.

Cook, G. (2003). *Athletic Body in Balance*. Champaign, Ill.: Human Kinetics.

Cook, G. & Jones, B. (2007a). *Secrets of the Shoulder*. www.functionalmovement.com

Cook, G. & Jones, B. (2007b). *Secrets of the Hip and Knee*. www.functionalmovement.com

Descarreaux, M. et al. (2008). Changes in the flexion relaxation response induced by lumbar muscle fatigue. *Biomed Central Musculoskeletal Disorders*, 9, 1.

DeVita, P. & Hortobágyi, T. (2003). Obesity is not associated with increased knee joint torque and power during level walking. *Journal of Biomechanics*, 36, 1355–1362.

Farrell, S.W. et al. (2002). The relation of body mass index, cardiorespiratory fitness, and all-cause mortality in women. *Obesity Research*, 10, 417–423.

Fasshauer, M. & Paschke, R. (2003). Regulation of adipocytokines and insulin resistance. *Diabetologia*, 46, 1594–1603.

Felson, D.T. et al. (1992). Weight loss reduces the risk for symptomatic knee osteoarthritis in women: The Framingham Study. *Annals of Internal Medicine*, 116, 535–9.

Fontaine, K.R. & Barofsky, I. (2001). Obesity and health-related quality of life. *Obesity Reviews*, 2, 173–182.

Fontaine, K.R. et al. (2003). Years of life lost due to obesity. *Journal of the American Medical Association*, 289, 187–193.

Froidevaux, F. et al. (1993). Energy expenditure in obese women before and during weight loss, after refeeding, and in the weight-relapse period. *American Journal of Clinical Nutrition,* 57, 35–42.

Gilleard, W. & Smith, T. (2007). Effect of obesity on posture and hip joint moments during a standing task, and trunk forward flexion motion. *International Journal of Obesity*, 31, 267–277.

Han, T.S. et al. (1997). The prevalence of low back pain and associations with body fatness, fat distribution and height. *International Journal of Obesity & Related Metabolic Disorders*, 21, 600–607.

Haskell, W.L. et al. (2007). Physical activity and public health updated recommendations from the American College of Sports Medicine and the American Heart Association. *Medicine & Science in Sports & Exercise*, 39, 1423–1434.

Helmchen, L.A. & Henderson, R.M. (2004). Changes in the distribution of body mass index of white U.S. men, 1890–2000. *Annals of Human Biology*, 31, 174–181.

Hills, A.P. et al. (2001). Plantar pressure differences between obese and non-obese adults: A biomechanical analysis. *International Journal of Obesity*, 25, 1674–1679.

Howard, B.V., Ruotolo, G., & Robbins, D.C. (2003). Obesity and dyslipidemia. *Endocrinology Metabolism Clinics of North America*, 32, 855–867.

Hulens, H. et al. (2001). Exercise capacity in lean versus obese women. *Scandinavian Journal of Medicine & Science in Sports*, 11, 305–309.

Jakicic, J.M. et al. (2008). Effect of exercise on 24-month weight loss maintenance in overweight women. *Archives of Internal Medicine*, 168, 1550–1559.

Jensen, G.L. (2005). Obesity and functional decline: Epidemiology and geriatric consequences. *Clinics in Geriatric Medicine*, 21, 677–687.

Kendall, F.P. et al. (2005). *Muscles Testing and Function with Posture and Pain* (5th ed.). Baltimore, Md.: Lippincott Williams & Wilkins.

Klem, M.L. et al. (1997). A descriptive study of individuals successful at long-term maintenance of substantial weight loss. *American Journal of Clinical Nutrition*, 66, 239–246.

Knowler, W.C. et al. (2002). Reduction in the incidence of type 2 diabetes with lifestyle intervention or metformin. *New England Journal of Medicine*, 346, 393–403.

Korkiakoski, A. et al. (2009). Association of lumbar arterial stenosis with low back symptoms: A cross-sectional study using two-dimensional time-of-flight magnetic resonance angiography. *Acta Radiologica*, 50, 48–54.

Leboeuf-Yde, C. (2000). Body weight and low back pain: A systematic literature review of 56 journal articles reporting on 65 epidemiologic studies. *Spine*, 25, 226–237.

Lee, C.D., Blair, S.N., & Jackson, A.S. (1999). Cardiorespiratory fitness, body composition, and all-cause and cardiovascular disease mortality in men. *American Journal of Clinical Nutrition*, 69, 373–380.

Lee, Y.H. & Pratley, R.E. (2007). Abdominal obesity and cardiovascular disease risk: The emerging role of the adipocyte. *Journal of Cardiopulmonary Rehabilitation*, 27, 2–10.

Lehman, G.L. (2004). Biomechanical assessments of lumbar spinal function: How low-back pain suffers differ from normals. Implications for outcome measures research. Part I: Kinematic assessments of lumbar function. *Journal of Manipulative & Physiological Therapy*, 27, 57–62.

Levin, B.E. & Dunn-Meynell, A.A. (2004). Chronic exercise lowers the defended body-weight gain and adiposity in diet-induced obese rats. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 286, 771–778.

Levin, B.E. & Dunn-Meynell, A.A. (2002). Defense of body weight depends on dietary composition and palatability in rats with diet-induced obesity. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 282, 46–54.

Levin, B.E. & Keesey RE. (1998). Defense of differing body weight set points in diet-induced obese and resistant rats. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 274, 412–419.

MacLean, P.S. et al. (2004a). Enhanced metabolic efficiency contributes to weight regain after weight loss in obesity-prone rats. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 287, 1306–1315.

MacLean, P.S. et al. (2004b). Metabolic adjustments with the development, treatment, and recurrence of obesity in obesity-prone rats. *American Journal of Physiology - Regulatory, Integrative and Comparative Physiology*, 287, 288–297.

McGill, S.M. (2007). *Low Back Disorders: Evidence Based Prevention and Rehabilitation* (2nd ed.). Champaign, Ill.: Human Kinetics.

McGill, S.M., Hughson, R.L., & Parks, K. (2000). Changes in lumbar lordosis modify the role of the extensor muscles. *Clinical Biomechanics*, 15, 777–780.

Messier, S.P. (2008). *The Burden of Obesity: A Biomechanical Perspective.* Presented at the ACSM 55th Annual Meeting, Indianapolis, Ind.: May 28, 2008.

Messier, S.P. (1994). Osteoarthritis of the knee and associated factors of age and obesity: Effects on gait. *Medicine & Science in Sports & Exercise*, 26, 1446–1452.

Messier, S.P. et al. (2005). Weight loss reduces knee-joint loads in overweight and obese older adults with knee osteoarthritis. *Arthritis & Rheumatism*, 52, 2026–2032.

Mora, S. et al. (2006). Association of physical activity and body mass index with novel and traditional cardiovascular biomarkers in women. *Journal of the American Medical Association*, 295, 1412–1419.

Morrato, E.H. et al. (2007) Physical activity in U.S. adults with diabetes and at risk for developing diabetes. *Diabetes Care*, 30, 203–209.

Nantel, J., Mathieu, M., & Prince, F. (2010). Physical activity and obesity: Biomechanical and physiological concepts. *Journal of Obesity*, 2011, E-pub Article ID 650230, 10 pages. doi:10.1155/2011/650230.

National Heart, Lung and Blood Institute (2000). *Obesity Education Initiative Expert Panel on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Practical Guide.* Bethesda, Md.: National Institutes of Health. NIH publication No. 00-4084.

National Heart, Lung and Blood Institute (1998). *Obesity Education Initiative Expert Panel. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.* Bethesda, Md.: National Institutes of Health. NIH publication No. 98-4083.

National Weight Control Registry (NCWR) (2012). *NCWR Facts*. National Weight Control Registry www.nwcr.ws/Research/default.htm. Retrieved April 6, 2012.

Nourbakhsh, M.R. & Arab, A.M. (2002). Relation between mechanical factors and incidence of low back pain. *Journal of Orthopaedic Sports & Physical Therapy*, 32, 447–460.

Núñez, N.P. et al. (2007). Extreme obesity reduces bone mineral density: Complementary evidence from mice and women. *Obesity*, 15, 1980–1987.

Ofir, D. et al. (2007). Ventilatory and perceptual responses to cycle exercise in obese women. *Journal of Applied Physiology*, 102, 2217–2226.

Ogden, C.L. et al. (2006). Prevalence of overweight and obesity in the United States, 1999–2004. *Journal of the American Medical Association*, 295, 1549–1555.

Panagiotakos, D.B. et al. (2005). The implication of obesity and central fat on markers of chronic inflammation: The ATTICA study. *Atherosclerosis*, 183, 308–315.

Panagiotakos, D.B. et al. (2004). The associations between leisure-time physical activity and inflammatory and coagulation markers related to cardiovascular disease: The ATTICA study. *Preventive Medicine*, 40, 432–437.

Park, H.S., Park, J.Y., & Yu, R. (2005). Relationship of obesity and visceral adiposity with serum concentrations of CRP, TNF-alpha, and IL6. *Diabetes Research & Clinical Practice*, 69, 29–35.

Sahrmann, S.A. (2002). *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, Mo.: Mosby.

Sarris, W.H. et al. (2003). How much physical activity is enough to prevent unhealthy weight gain? Outcome of the IASO 1st Stock Conference and consensus statement. *Obesity Reviews*, 4, 101–114.

Shiri, R. (2008). Obesity and the prevalence of low-back pain in young adults. *American Journal of Epidemiology*, 167, 1110–1119.

Shiri, R.,et al. (2010). The association between obesity and low-back pain: A meta-analysis. *American Journal of Epidemiology*, 171, 135–154.

Spyropoulos, P. et al. (1991). Biomechanical gait analysis in obese men. *Archives of Physical Medicine & Rehabilitation*, 72, 1065–1070.

Stein, C.J. & Colditz, G.A. (2004). The epidemic of obesity. *Journal of Clinical Endocrinology & Metabolism*, 89, 2522–2525.

Sullivan, P.W. et al. (2005). Obesity, inactivity, and the prevalence of diabetes and diabetes-related cardiovascular comorbidities in the U.S., 2000–2002. *Diabetes Care*, 28, 1599–1603.

Toda, Y. et al. (2000). Lean body mass and body fat distribution in participants with chronic low back pain. *Archives of Internal Medicine*, 160, 3265–3269.

U.S. Department of Agriculture (2010). *Dietary Guidelines for Americans 2010.* www.dietaryguidelines.gov

U.S. Department of Health & Human Services (2008). *2008 Physical Activity Guidelines for Americans: Be Active, Healthy and Happy.* www.health.gov/paguidelines/pdf/paguide.pdf

Vismara, L. et al. (2010) Effect of obesity and low back pain on spinal mobility: A cross sectional study in women. *Journal of NeuroEngineering and Rehabilitation*, 7, 3.

Votruba, S.B., Blanc, S., & Schoeller, D.A. (2002). Pattern and cost of weight gain in previously obese women. *American Journal of Physiology – Endocrinology and Metabolism*, 282, 923–930.

Whiting W.C. & Rugg, S. (2006). *Dynatomy: Dynamic Human Anatomy*. Champaign, Ill.: Human Kinetics.

Wisse, B.E. (2004). The inflammatory syndrome: The role of adipose tissue cytokines in metabolic disorders linked to obesity. *Journal of the American Society of Nephrology*, 15, 2792–2800.

Zoeller, R.F. (2007). Physical activity and obesity: Their interaction and implications for disease risk and the role of physical activity in healthy weight management. *American Journal of Lifestyle Medicine*, 6, 437–446.

Suggested Reading

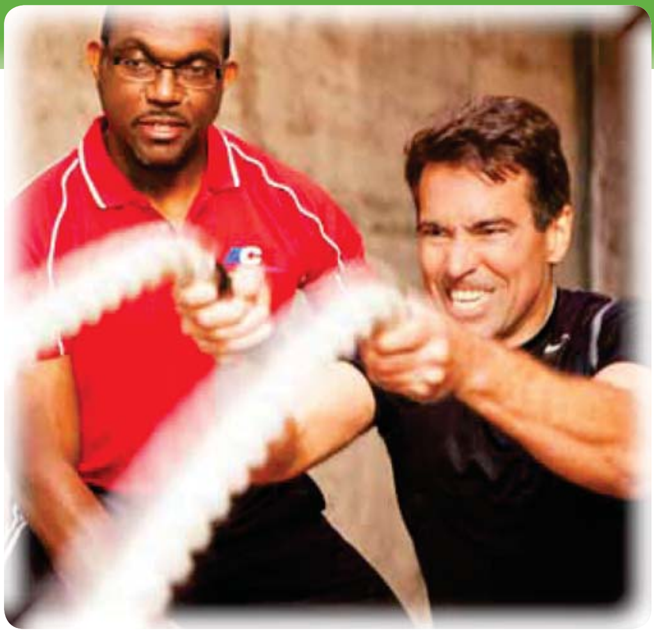
American College of Sports Medicine (2009). Position stand: Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine & Science in Sports & Exercise*, 41, 459–471.

American Council on Exercise (2010). *ACE Personal Trainer Manual* (4th ed.). San Diego, Calif.: American Council on Exercise.

National Heart, Lung and Blood Institute (1998). *Obesity Education Initiative Expert Panel. Clinical Guidelines on the Identification, Evaluation, and Treatment of Overweight and Obesity in Adults: The Evidence Report.* Bethesda, Md.: National Institutes of Health. NIH publication No. 98-4083.

U.S. Department of Agriculture (2010). *Dietary Guidelines for Americans 2010.* www.dietaryguidelines.gov

U.S. Department of Health & Human Services (2008). *2008 Physical Activity Guidelines for Americans: Be Active, Healthy and Happy.* www.health.gov/paguidelines/pdf/paguide.pdf



IN THIS CHAPTER:

Fabio Comana, M.A., M.S., is the director of continuing education for the National Academy of Sports Medicine (NASM) and a faculty member in Exercise Science and Nutrition at San Diego State University and UC San Diego. Comana holds numerous fitness certifications from ACE, NASM, the American College of Sports Medicine, and the International Society of Sports Nutrition. Previously, he was an exercise physiologist and certification manager for the American Council on Exercise (ACE) where he played a key role in the development of ACE's Integrated Fitness Training® Model and many of ACE's live personal-training educational workshops. His previous experiences include collegiate head coaching, strength and conditioning coaching, and opening and managing health clubs for Club One. As a national and international presenter, he is frequently featured on television, radio, internet, and in print publications. He authored chapters in various textbooks and publications, and is presently authoring upcoming academic and consumer books.

17 Exercise Program Design

FABIO COMANA & SABRENA MERRILL

Sabrena Merrill, M.S., has been actively involved in the fitness industry since 1987, successfully operating her own personal-training business and teaching group exercise classes. Merrill is a former full-time faculty member in the Kinesiology and Physical Education Department at California State University, Long Beach. She has a bachelor's degree in exercise science as well as a master's degree in physical education/biomechanics from the University of Kansas. Merrill, an ACE-certified Personal Trainer and Group Fitness Instructor, is an author, educator, and fitness consultant who remains very active within the industry.

In Chapter 16, an overview of components and phases of the ACE Integrated Fitness® (ACE IFT®) Training Model was presented. This chapter explores each phase of the ACE IFT model as it relates to safe and effective exercise programming. Specifically, the programming focus is on the successful facilitation of weight loss in overweight or obese individuals. However, the concepts presented can be applied to any individual as he or she progresses through the health–fitness–performance continuum.

Cardiorespiratory Training Based on the ACE IFT Model

Since regular aerobic endurance exercise is the mode of activity that is responsible for the greatest success in long-term weight loss with overweight and obese individuals, the discussion of exercise programming begins with cardiorespiratory training. The basic concept of program design is to create an exercise program with appropriate frequency, intensity, and duration to fit the client's current health and fitness, with adequate progressions to help the client safely achieve his or her goals. The ACE IFT Model has four cardiorespiratory training phases:

- Phase 1: Aerobic-base training
- Phase 2: Aerobic-efficiency training
- Phase 3: Anaerobic-endurance training
- Phase 4: Anaerobic-power training

Clients are categorized into a given phase based on their current health, fitness levels, and goals. By utilizing the assessment and programming tools in each phase, ACE-certified Health Coaches can develop individualized cardiorespiratory programs for clients ranging from sedentary to endurance athletes. Programming in each phase will be based on the **heart rate (HR)** training three-zone model shown in Figure 17-1, using HR at the **first ventilatory threshold (VT1)** and the **second**

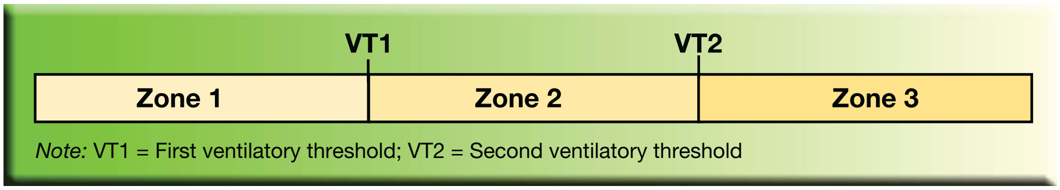


Figure 17-1
Three-zone training model

> Stated simply, if a client can talk comfortably, he or she is training in zone 1. If the client is not sure if he or she can talk comfortably, he or she is working in zone 2. If the client definitely cannot talk comfortably while training, he or she is working in zone 3.

ventilatory threshold (VT2) to develop individualized programs based on each client's unique metabolic responses to exercise (see pages 329–332). These two metabolic markers provide a convenient way to divide intensity into training zones that are determined without any use of, or reference to, **maximum heart rate (MHR):**

- Zone 1 (relatively easy exercise) reflects heart rates below VT1.
- Zone 2 reflects heart rates from VT1 to just below VT2.
- Zone 3 reflects heart rates at and above VT2.

It is important to note that training principles in the ACE IFT Model's cardiorespiratory training phases can be implemented using various exercise intensity markers, including ones based on predicted values such as a percentage of **heart-rate reserve** (%**HRR**) or a percentage of maximum heart rate (%MHR), but the exercise intensities will not be as accurate for individual clients as when they utilize measured HR at VT1 and VT2 (Table 17-1).

Table 17-1

Three-zone Training Model Using Various Intensity Markers

Intensity Markers	Zone 1	Zone 2	Zone 3	Advantages/Limitations
Metabolic markers: VT1 and VT2* (HR relative to VT1 and VT2)*	Below VT1 (HR <VT1)	VT1 to just below VT2 (HR ≥VT1 to <VT2)	VT2 and above (HR ≥VT2)	• Based on measured VT1 and VT2 • Ideally, VT1 and VT2 are measured in a lab with a metabolic cart and blood lactate • Field tests are relatively easy to administer, require minimal equipment, and provide accurate corresponding HRs at VT1 and VT2 • Programming with metabolic markers allows for individualized programming
Talk test*	Can talk comfortably	Not sure if talking is comfortable	Definitely cannot talk comfortably	• Based on actual changes in ventilation due to physiological adaptations to increasing exercise intensities • Very easy for practical measurement • No equipment required • Can easily be taught to clients • Allows for individualized programming
RPE (terminology)*	"Moderate" to "somewhat hard"	"Hard"	"Very hard" to "extremely hard"	• Good subjective intensity marker • Correlates well with talk test, metabolic markers, and measured $\%\dot{V}O_2max$ • Easy to teach to clients

Table 17-1 *continued*

Three-zone Training Model Using Various Intensity Markers

Intensity Markers	Zone 1	Zone 2	Zone 3	Advantages/Limitations
RPE (0 to 10 scale)*	3 to 4	5 to 6	7 to 10	• Good subjective intensity marker • Correlates well with talk test, metabolic markers, and measured % $\dot{V}O_2$max • 0 to 10 scale is easy to teach to clients
RPE (6 to 20 scale)	12 to 13	14 to 16	17 to 20	• Good subjective intensity marker • Correlates well with talk test, metabolic markers, and measured % $\dot{V}O_2$max • 6 to 20 scale is not as easy to teach to clients as the 0 to 10 scale • *Note:* An RPE of 20 represents maximal effort and cannot be sustained as a training intensity.
%$\dot{V}O_2$R	40 to 59%	60 to 84%	≥85%	• Requires *measured* $\dot{V}O_2$max for most accurate programming • Impractical due to expensive equipment and testing • Increased error with use of *predicted* $\dot{V}O_2$max or *predicted* MHR • Relative percentages for programming are population-based and not individually specific
%HRR	40 to 59%	60 to 84%	≥85%	• Requires *measured* MHR and RHR for most accurate programming • Measured MHR is impractical for the vast majority of health coaches and clients • Use of RHR increases individuality of programming vs. strict %MHR • Use of *predicted* MHR introduces potentially large error; the magnitude of the error is dependent on the specific equation used • Relative percentages for programming are population-based and not individually specific
%MHR	64 to 76%	77 to 93%	≥94%	• Requires *measured* MHR for accuracy in programming • Measured MHR is impractical for the vast majority of health coaches and clients • Use of *predicted* MHR introduces potentially large error; the magnitude of the error is dependent on the specific equation used • Does not include RHR, as is used in %HRR • Relative percentages for programming are population-based and not individually specific
METs	3 to 6	6 to 9	>9	• Requires *measured* $\dot{V}O_2$max for most accurate programming • Can use in programming more easily than other intensity markers based off $\dot{V}O_2$max • Limited in programming by knowledge of METs for given activities and/or equipment that gives MET estimates • Relative MET ranges for programming are population-based and not individually specific (e.g., a 5-MET activity might initially be perceived as vigorous by a previously sedentary client)
Category terminology for exercise programming	Low to moderate	Moderate to vigorous	Vigorous to very vigorous	

Note: VT1 = First ventilatory threshold; VT2 = Second ventilatory threshold; HR = Heart rate; RPE = Ratings of perceived exertion; $\dot{V}O_2$max = $\dot{V}O_2$maximum; $\dot{V}O_2$R = VO_2 reserve; HRR = Heart-rate reserve; MHR = Maximum heart rate; RHR = Resting heart rate; METs = Metabolic equivalents

*These are the preferred intensity markers to use with the three-zone model when designing, implementing, and progressing cardiorespiratory training programs using the ACE Integrated Fitness Training Model.

Table 17-2 provides an overview of the cardiorespiratory training phases of the ACE IFT Model. This is followed by detailed descriptions that explain the training focus of each stage and strategies for implementing and progressing exercise programs to help clients reach

Table 17-2

Cardiorespiratory Training Phase Overview

Phase 1—Aerobic-base Training

- The focus is on creating positive exercise experiences that help sedentary clients become regular exercisers.
- No fitness assessments are required prior to exercise in this phase.
- Focus on steady-state exercise in zone 1 (below HR at VT1).
- Gauge by the client's ability to talk (below talk test threshold) and/or RPE of 3 to 4 (moderate to somewhat hard).
- Progress to phase 2 once the client can sustain steady-state cardiorespiratory exercise for 20 to 30 minutes in zone 1 (RPE of 3 to 4) and is comfortable with assessments.

Phase 2—Aerobic-efficiency Training

- The focus is on increasing the duration of exercise and introducing intervals to improve aerobic efficiency, fitness, and health.
- Administer the submaximal talk test to determine HR at VT1. There is no need to measure VT2 in phase 2.
- Increase workload at VT1 (increase HR at VT1), then introduce low zone 2 intervals just above VT1 (RPE of 5) to improve aerobic efficiency and add variety in programming.
- Progress low zone 2 intervals by increasing the time of the work interval and later decreasing the recovery interval time.
- As client progresses, introduce intervals in the upper end of zone 2 (RPE of 6).
- Many clients will stay in this phase for many years.
- If a client has event-specific goals or is a fitness enthusiast looking for increased challenges and fitness gains, progress to phase 3.

Phase 3—Anaerobic-endurance Training

- The focus is on designing programs to help clients who have endurance performance goals and/or are performing seven or more hours of cardiorespiratory exercise per week.
- Administer the VT2 threshold test to determine HR at VT2.
- Programs will have the majority of cardiorespiratory training time in zone 1.
- Interval and higher-intensity sessions will be very focused in zones 2 and 3, but will make up only a small amount of the total training time to allow for adaptation to the total training load.
- Many clients will never train in phase 3, as all of their non-competitive fitness goals can be achieved through phase 2 training.
- Only clients who have very specific goals for increasing speed for short bursts at near-maximal efforts during endurance or athletic competitions will move on to phase 4.

Phase 4—Anaerobic-power Training

- The focus is on improving anaerobic power to improve phosphagen energy pathways and buffer large accumulations of blood lactate in order to improve speed for short bursts at near-maximal efforts during endurance or athletic competitions.
- Programs will have a similar distribution to phase 3 training times in zones 1, 2, and 3.
- Zone 3 training will include very intense anaerobic-power intervals.
- Clients will generally only work in phase 4 during specific training cycles prior to competition.

Note: HR = Heart rate; VT1 = First ventilatory threshold; RPE = Ratings of perceived exertion; VT2 = Second ventilatory threshold their goals within the phase, and then advance to the next phase if desired. It is important to note that not every client will start in phase 1, as some clients will already be regularly participating in cardiorespiratory exercise, and only clients with very specific performance or speed goals will move into phase 3 and reach phase 4. In addition, the submaximal **talk test** for VT1 (see page 329) is recommended for introduction in phase 2, while the field test for VT2 (see page 332) should ideally be introduced during phase 3. Also, clients may be in different phases for cardiorespiratory training and functional movement and resistance training based on their current health, fitness, exercise-participation levels, and goals.

Phase 1: Aerobic-base Training

Phase 1 has a principal focus of getting clients who are either sedentary or have little cardiorespiratory fitness to begin engaging in regular cardiorespiratory exercise of low-to-moderate intensity with a primary goal of improving health and a secondary goal of building fitness. These clients may have long-term goals for fitness and possibly even sports performance, but they need to progress through phase 1 first. The primary goal for the health coach during this phase should be to help the client have positive experiences with cardiorespiratory exercise and to help him or her adopt exercise as a regular habit. The intent of this phase is to develop a stable aerobic base upon which the client can build improvements in health, endurance, energy, mood, and caloric expenditure.

Once regularity of exercise habits is established, the duration of exercise is extended until the individual can perform 20 to 30 continuous minutes of cardiorespiratory exercise on most days with little residual fatigue, at which point they can progress to phase 2. This approach to training ensures the safety of exercise, while at the same time allowing some of the potential physiologic adaptations and most of the health benefits to occur. Within this general design is recognition that the benefit-to-risk ratio of low-intensity zone 1 training is very high for the beginning exerciser, with the possibility for very large gains in health and basic fitness and almost no risk of either cardiovascular or musculoskeletal injury. As the exerciser develops more ambitious goals, more demanding training (either longer or more intense) can be performed.

Program Design for Phase 1: Aerobic-base Training

The primary goal of this phase is to help clients have positive experiences with exercise to facilitate program adherence and success. Cardiorespiratory fitness assessments are not necessary at the beginning of this phase, as they will only confirm low levels of fitness and potentially serve as negative reminders about why the sedentary client with low levels of fitness may not have good **self-efficacy** regarding exercise. All cardiorespiratory exercise during this phase falls within zone 1 (sub-VT1), so the health coach can use the client's ability to talk comfortably as the upper exercise-intensity limit. The health coach can also teach the client to use the 0 to 10 category ratio scale, with the client exercising at a **rating of perceived exertion (RPE)** of 3 to 4 (moderate to somewhat hard) (Table 17-3). It is not necessary to conduct the submaximal talk test assessment to determine HR at VT1 until phase 2.

As a general principle, exercise programs designed to improve the aerobic base begin with zone 1–intensity exercise with HR below VT1 performed for as little as 10 to 15 minutes two to three times each week. However, this should be progressed as rapidly as

Table 17-3

Ratings of Perceived Exertion (RPE)

RPE	Category Ratio Scale
6	0 Nothing at all
7 Very, very light	0.5 Very, very weak
8	1 Very weak
9 Very light	2 Weak
10	3 Moderate
11 Fairly light	4 Somewhat strong
12	5 Strong
13 Somewhat hard	6
14	7 Very strong
15 Hard	8
16	9
17 Very hard	10 Very, very strong
18	* Maximal
19 Very, very hard	
20	

Adapted, with permission, from American College of Sports Medicine (2010). *ACSM's Guidelines for Exercise Testing and Prescription* (8th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.

tolerated to 30 minutes at moderate intensity (zone 1; below "talk test" with HR below VT1), performed at least five times each week. Changes in duration from one week to the next should not exceed a 10% increase versus the week prior. Once this level of exercise can be sustained on a regular basis, the primary adaptation of the aerobic base will be complete.

For the most part, early training efforts should feature continuous exercise at zone 1 intensity. Depending on how sedentary a person was prior to beginning the program, this level of easy exercise may be continued for as little as one to two weeks or for as long as six weeks. The beginning duration of exercise should match what the client is able to perform. For some, this might be 15 continuous minutes, while for others it might be only five to 10 continuous minutes. From that point, duration should be increased at a rate of no more than 10% from one week to the next until the client can perform 30 minutes of continuous exercise. Once the client is comfortable with assessments and can sustain steady-state cardiorespiratory exercise for 20 minutes in zone 1 (RPE of 3 to 4), he or she can move onto phase 2.

A sample aerobic-base (phase 1) training progression for a client exercising four days per week is illustrated in Table 17-4. This sample shows appropriate progressions for weekly duration with different options for session duration during most weeks to add variety and accommodate other program goals.

Table 17-4

Sample Phase 1 Cardiorespiratory-training Progression

Training Parameter	Week 1	Week 2	Week 3	Week 4	Week 5
Frequency	4 times/week	4 times/week	4 times/week	4 times/week	4 times/week
Duration—Total for Week: (10% weekly increase)	60 min/week	66 min/week	72 min/week	80 min/week	88 min/week
Duration of Sessions (continuous)	4 x 15 min	4 x 16.5 min or 2 x 15 min 2 x 18.5 min	4 x 18 min or 2 x 17 min 2 x 19 min	4 x 20 min or 2 x 18 min 2 x 22 min	4 x 22 min or 2 x 20 min 2 x 24 min
Intensity	<VT1 HR RPE = 3	<VT1 HR RPE = 3	<VT1 HR RPE = 3	<VT1 HR RPE = 3 to 4	<VT1 HR RPE = 3 to 4
Zone	1	1	1	1	1
Training Format	Steady state	Steady state	Steady state	Steady state	Steady state
Work-to-Recovery Intervals (active recovery)	None	None	None	None	None

Note: VT1 = First ventilatory threshold; RPE = Ratings of perceived exertion

APPLY WHAT YOU KNOW

Using Technology to Your Advantage—ACE IFT Model Phase 1: Special Considerations for Overweight/Obese Individuals

Two important considerations related to aerobic exercise training for overweight and obese clients are the appropriateness of the exercise equipment and the individual's ability to tolerate the duration of activity. In both cases, the use of technological advances in exercise equipment or devices can be useful.

Both upright and recumbent cycling are popular modes of aerobic activity for obese individuals. However, the seats on many of the cycles are too narrow and not supportive enough for exercisers with higher BMIs. Before having an obese client embark on a cycling program, the health coach should ensure that the seat is wide enough for proper support and has enough cushioning for added comfort. Typically, recumbent models have adequate seat size and cushioning, as well as the added benefit of back support. A relatively unique type of exercise equipment called recumbent cross trainers are also excellent options for obese exercisers. These machines are a cross between a stair climbing machine with moveable handles and a recumbent bike. They allow the exerciser to work the upper and lower body at the same time without stressing the joints, and they can accommodate a variety of body types and sizes (Figure 17-2).

Figure 17-2
Recumbent cross trainer
Photo courtesy of www.nustep.com.

The musculoskeletal discomfort associated with obesity can make a prolonged exercise session (e.g., 30 minutes or more) intolerable. During the initial period of training, recommending that obese clients accumulate the desired number of minutes of exercise throughout the day, rather than all at once, might help ease any muscle or joint pain associated with physical activity. Even if the client has no other option but to walk for exercise, splitting up the session can reduce the musculoskeletal demands of the activity.

Pedometers track the number of steps an individual takes throughout a given time period. They can be an exceptionally motivating tool to help obese clients accumulate meaningful physical activity, especially if they sit at a desk for most of their workday.

One option for utilizing pedometers is to have the client set an alarm to go off every hour as a prompt to get up and move. Once the alarm sounds, the client takes a walk around the building. For even more accountability, the client can log in an exercise journal the total number of steps taken each day with a goal of getting in at least 50 to 100 steps every hour. More advanced pedometers also allow the user to download the data and keep track of the number of steps taken on a computer so that additional journal materials are unnecessary. Eventually, the client can add in extra challenges like taking the stairs during the walk and pacing for increased speed, as long as these challenges do not induce undue musculoskeletal pain.

THINK IT THROUGH

What are examples of family-based or community-based activities that obese individuals can incorporate into their lifestyles to promote exercise and increased movement as a shared experience with their loved ones and/or friends?

Phase 2: Aerobic-efficiency Training

Phase 2 has a principal training focus of increasing the time of cardiorespiratory exercise while introducing intervals to improve the ability to exercise at greater workloads to improve fitness and increase caloric expenditure. However, it is important to understand that after an aerobic base has been achieved, additional gains in fitness will require increases in training intensity, frequency, or duration. At this time, the health coach should review the goals of the client. What are the client's exercise goals—health and basic fitness benefits, improved appearance, and/or weight-loss benefits?

Phase 2 is the primary cardiorespiratory training phase for regular exercisers in a fitness facility who have goals for improving or maintaining fitness and/or weight loss. Cardiorespiratory training in this phase includes increasing the workload by modifying frequency, duration, and intensity, with intervals introduced that go into zone 2 and eventually approach HR at VT2. The zone 2 intervals in this phase provide a stimulus that will eventually increase the HR at VT1, resulting in the client being able to exercise at a lower HR when at the same level of intensity, and also allowing the client to exercise at higher intensities, expending more calories per minute, while at the VT1 HR.

Clients training in phase 2 who have a goal to complete an event, such as a 10K run, can reach their goal of completing the event within the training guidelines of this phase. Once a client begins working toward multiple endurance performance goals, trains to improve his or her competitive speed, begins training seven or more hours per week, or simply wants to take on the challenge of training like an athlete, the client should move on to phase 3 of cardiorespiratory training.

For the many clients who never develop competitive goals or the desire to train like an endurance athlete, training in phase 2 will provide very adequate challenges to help them improve and maintain cardiorespiratory fitness for many years. The workouts in most non-athletically focused group exercise classes fall into this phase. Phase 2 covers the principles for building aerobic efficiency that are implemented with most health coach clients and fitness enthusiasts.

Program Design for Phase 2: Aerobic-efficiency Training

At the beginning of phase 2, the health coach should have the client perform the submaximal talk test to determine HR at VT1 (see page 329). This HR will be utilized for programming throughout the phase, and will need to be reassessed periodically as fitness improves to see if the HR at VT1 has increased and training intensities need to be adjusted.

This phase of cardiorespiratory training is dedicated to enhancing the client's aerobic efficiency by progressing the program through increased duration of sessions, increased frequency of sessions when possible, and the introduction of zone 2 intervals. In phase 2, the warm-up, cool-down, recovery intervals, and steady-state cardiorespiratory exercise segments are performed at or just below VT1 at an RPE of 3 to 4 (0 to 10 scale) to continue advancing the client's aerobic base. Aerobic intervals are introduced at a level that is just above VT1, or an RPE of 5 (0 to 10 scale). The goal of these intervals is to improve aerobic efficiency by raising the intensity of exercise performed at VT1, improve the client's ability to utilize fat as a fuel source at and just above VT1, improve exercise efficiency at VT1, and add variety to the exercise program.

As a general principle, intervals should start out relatively brief (initially about 60 seconds), with an approximate hard-to-easy ratio of 1:3 (e.g., a 60-second work interval followed by a 180-second recovery interval), eventually progressing to a ratio of 1:2 and then 1:1. The duration of these intervals can be increased in regular increments, depending on the goals of the exerciser, but should be increased cautiously over several weeks depending on the client's fitness level. As a general principle, the exercise load (calculated from the session RPE or the integrated time in the zone) should be increased by no more than 10% per week. Early in phase 2, exercise bouts with a session RPE greater than 5 (e.g., hard exercise) should be performed infrequently. As the client's fitness increases, steady-state exercise sessions with efforts just above VT1 (RPE of 5) can be introduced.

EXPAND YOUR KNOWLEDGE

Session RPE

Selecting an appropriate intensity is always a major challenge for health coaches who seek proper levels of overload, yet want to create an optimal experience, especially when working with newer, deconditioned clients, clients who are apprehensive about undergoing cardiorespiratory fitness testing, and individuals for whom heart-rate measures are invalid (e.g., those taking beta blockers).

The "session RPE" was developed as a method of monitoring the combined intensity and duration of an exercise session (Herman et al., 2006; Foster et al., 1995). If an individual is asked to rate the overall intensity of an exercise bout about 30 minutes after the conclusion of that bout using the category ratio (0 to 10) scale, and then multiplies this rating by the duration of the bout, a score representing the combined intensity and duration of the bout is generated (i.e., the training load) (Foster et al., 2001; Foster, Daniels, & Seiler, 1999; Foster et al., 1996). In practice, this daily score can be summated on a weekly basis, generating a weekly training load for self-monitoring purposes. This is an effective programming and monitoring tool that promotes appropriate initial exercise intensities, creates some ownership of programming on the part of the client, and allows a limited degree of training flexibility to facilitate adherence.

This model can be used exclusively and indefinitely to monitor exercise intensity, or health coaches may opt to use it during only the initial stage of a clients' program, perhaps before conducting any cardiorespiratory tests for aerobic fitness. Health coaches should adhere to the following guidelines when using the session RPE model:

- Spend time helping the client become familiar with the 0 to 10 RPE scale.
- Determine appropriate RPE intensities for each exercise session based on the client's current activity levels, while providing a small overload challenge (e.g., a 5-out-of-10 effort for someone who has been exercising at a 4-to-4½ effort).

- Identify the frequency and duration that is appropriate for the client's current conditioning level and feasible within his or her schedule (e.g., three times a week for 15 minutes).
- Implement a RPE-training volume model (i.e., RPE x frequency x duration).
  - ✓ For example, Joe's key goal is to improve his cardiorespiratory fitness, and he and his health coach mutually decide that a feasible start is for him to participate in cardiovascular training sessions three times each week for approximately 20 minutes each, at a 5-out-of-10 effort.
  - ✓ His total weekly training volume is 3 x 20 minutes = 60 minutes, and his target goal for week one = 60 minutes x RPE of 5 = 300 points.
  - ✓ Joe's progression over three weeks at a 10% progression rate per week:
    - Week 1 = 300 points
    - Week 2 = 330 points
    - Week 3 = 365 points
  - ✓ The health coach can provide Joe options on how he can achieve his target number by manipulating any of the three variables (i.e., intensity, frequency, and duration) (Table 17-5). While allowing Joe some flexibility and ownership of his program, the health coach should subscribe to the K.I.S.S. principle (keep it simple and short) to avoid confusion and potential drop-out.

Table 17-5

Training Progression and Options Using Frequency x Duration x Intensity (RPE)

	Frequency	Duration	Intensity (RPE)	Total Points
Week 1 goal				300
Options	3 sessions	x 20	x 5	= 300
	2 sessions 1 session	x 20 x 18	x 5 x 5.5	= 200 = 99 299
	2 sessions 2 sessions	x 16 x 13	x 5 x 5.5	= 160 = 143 303
Week 2 goal				330
Options	3 sessions	x 22	x 5	= 330
	2 sessions 1 session	x 22 x 18	x 5 x 6	= 220 = 108 328
	2 sessions 2 sessions	x 19 x 16.5	x 4 x 5.5	= 152 = 181 333

Note: RPE = Ratings of perceived exertion

Low zone 2 intervals should first be progressed by increasing the time of each interval and then moving to a 1:1 work-to-recovery (hard-to-easy) interval ratio. As the client progresses, intervals can progress into the upper end of zone 2 (RPE of 6) at a 1:3 work-to-recovery ratio, progressing first to longer intervals and then eventually moving to intervals with a 1:1 work-to-recovery ratio. Well-trained and motivated non-athletes can progress to where they are performing as much as 50% of their cardiorespiratory training in zone 2. Once the well-trained non-athlete reaches seven or more hours of training per week or develops performance goals, he or she should progress to phase 3. Clients with advanced fitness who are training for a one-time event or are preparing to advance to phase 3, can perform brief intervals (up to 30 seconds) that go just above VT2 (RPE of 7) to further develop aerobic capacity and provide additional variety.

It is not necessary to measure VT2 during this phase, as an RPE of 5 to 6 (0 to 10 scale) can be used to represent intensities in zone 2, and an RPE of 7 (very hard) can be used to identify efforts just above VT2. Programming variables and variety during phase 2 are diverse enough for clients who do not have competitive goals to train in this phase for many years. A sample cardiorespiratory-training progression for a client in phase 2 is presented in Table 17-6. This sample shows appropriate progressions for weekly duration with different options for session duration during most weeks to add variety and accommodate other program goals.

Table 17-6

Sample Phase 2 Cardiorespiratory-training Progression

Training Parameter	Week 1	Week 2	Week 3	Week 4	Week 5
Frequency	3 times/week	3–4 times/week	3–4 times/week	4 times/week	4–5 times/week
Duration (10% weekly increase)	"X" minutes	10% increase	10% increase	10% increase	10% increase
Intensity	Below VT1 HR	Below and above VT1 HR	Below and above VT1 HR	Below and above VT1 HR	Above VT1 HR
Zone	1	1 and 2	1 and 2	1 and 2	1 and 2
Training Format	Steady state	Aerobic intervals	Aerobic intervals	Aerobic intervals	Aerobic intervals
Work-to-Recovery Intervals (active recovery)	None	1:2 2–3 minute intervals	1:2 3–4 minute intervals	1:1½ 3–4 minute intervals	1:1 4–5 minute intervals

Note: VT1 = First ventilatory threshold; HR = Heart rate

APPLY WHAT YOU KNOW

Using Technology to Your Advantage—ACE IFT Model Phase 2: Special Considerations for Overweight/Obese Individuals

An effective way to introduce aerobic-interval training to overweight and obese clients is to make the activity enjoyable and relevant. The use of a personal digital music player can be a simple tool that makes performing the more intense work required during an aerobic interval more fun and meaningful to the client. This strategy can be used with any type of land-based aerobic endurance exercise modality (e.g., cycling, walking on the treadmill, walking outdoors, and elliptical training).

- The first step is to ask the client to make a continuous playlist using five to 10 songs that he or she finds particularly uplifting and motivating. Given that most songs are approximately three minutes in duration, the playlist will most likely be 15 to 30 minutes long.
- The second step is to instruct the client to identify the chorus of each song and commit to working harder during the chorus. Thus, each time the chorus starts to play, the client has an opportunity to exert a little more energy with the knowledge that when the chorus is finished, he or she can revert back to the less-intense work that should be performed for the majority of the song. Typically, the chorus segments of most radio-edit music last about 20 to 45 seconds.

This method allows clients to explore their limits of intensity while listening to their favorite music. For added interest and motivation, clients can be encouraged to create more playlists so that they have a variety of music from which to choose. Additionally, as clients progress in their endurance capabilities, more songs can be added to the playlist to increase the duration of the exercise session.

Phase 3: Anaerobic-endurance Training

Phase 3 is designed for clients who have endurance-performance goals and are performing seven or more hours of cardiorespiratory training per week. The training principles in phase 3 are for clients who have one or more endurance-performance goals that require specialized training to ensure that adequate training volume and appropriate training intensity and recovery are included to create performance changes that help the client reach his or her goals. Clients do not need to be highly competitive athletes to train in zone 3. They need only to be motivated clients with endurance-performance goals and the requisite fitness from phase 2 to build upon.

A variety of studies with different types of athletes, including Nordic skiers, cyclists, and runners, have suggested that 70 to 80% of training is performed at intensities lower than VT1 (zone 1) (Seiler & Kjerland, 2006; Esteve-Lanao et al., 2005). These same studies suggest that athletes typically perform 5 to 10% of their training above VT2 (zone 3). Thus, even though zone 3 training can be very effective in terms of provoking improvements, only a small amount is tolerable, even in competitive athletes. Surprisingly, very little training is actually performed in the intensity zone between the two thresholds (zone 2). This intensity has been called "the black hole" (where there is a psychological push to do more, but a physiologic pull to do less), since it is the zone where exercise is hard enough to make a person fatigued, but not hard enough to really provoke optimal adaptations (Seiler & Kjerland, 2006).

In individuals who are already routinely exercising and who desire to move toward their optimal biological potential, most training (approximately 80%) should be performed at intensities where speech is comfortable (zone 1), and about 10% of training should be performed at intensities above VT2 (zone 3), where the physiological provocation to make large gains is present.

With the increase in training load during phase 3, consideration must also be given to the amount of recovery training. Where the regular recreational exerciser in the aerobic base phase of training (phase1) can safely and comfortably perform essentially the same training bout every day, the competitive-level exerciser will need to use a decidedly hard/easy approach to training, or he or she will be at risk for problems from accumulating fatigue and loss of training benefit from the inability to repeatedly do really hard training sessions. In any case, even in the most seriously trained athlete, it is probably not productive to perform more than three or four high-intensity or very long training sessions per week.

Program Design for Phase 3: Anaerobic-endurance Training

Program design during this phase should be focused on helping the client enhance his or her aerobic efficiency to ensure completion of goal events, while building anaerobic endurance to achieve endurance-performance goals. Improved anaerobic endurance will help the client perform physical work at or near VT2 for an extended period, which will result in improved endurance, speed, and power to meet primary performance goals.

To program effective intervals for improving anaerobic endurance, the health coach should have the client perform the field test for VT2 to determine the client's HR at VT2 (see page 332). Once the health coach has current values for the client's HR at VT1 and VT2, he or she can establish a three-zone model that is specific to the client. For example, if a client's HR at VT1 is 143 bpm and HR at VT2 is 162 bpm, the client's HR zones would be as follows:

- Zone 1 = less than 143 bpm
- Zone 2 = 143 to 161 bpm
- Zone 3 = 162 bpm and above

These HR zones can then be used as intensity markers to help the client stay within the correct zone for the desired training outcome of a given workout.

Training intensity should be varied, with 70 to 80% of training in zone 1, approximately 10% to 20% of training in zone 3, and only brief periods (less that 10%) in zone 2. This large volume of zone 1 training time is critical to program success for clients with endurance-performance goals, as exercise frequency, intensity, and time all add to the total load. Individuals who increase each of these variables too quickly are at risk for burnout and overuse injuries. Table 17-7 illustrates the work in zones 1, 2, and 3 that might be performed by a client training for a marathon during a four-week training period.

Table 17-7

Sample Phase 3 Cardiorespiratory-training Program: Four-week Period for Marathon Training

Training Parameter	Week 1— Increase Intensity	Week 2— Increase Intensity	Week 3— Increase Intensity	Week 4— Recovery Week
Training Volume	Total training time = 9 hours	Total training time = 9.5 hours	Total training time = 10 hours	Total training time = 6.5 to 7.5 hours
Zone 1 (~80% of volume) 3 workouts per week plus warm-up, cool-down, and rest intervals during zone 2 and 3 workouts	1 time/week Long run = 2 hours 30 min 1 time/week 90-min run (RPE = 4) 1 time/week 60-min run (RPE = 3–4)	1 time/week Long run = 2 hours 45 min 1 time/week 90-min run (RPE = 4) 1 time/week 60-min run (RPE = 3–4)	1 time/week Long run = 3 hours 1 time/week 90-min run (RPE = 4) 1 time/week 60-min run (RPE = 3–4)	1 time/week Long run = 2 hours 1 time/week 60-min run (RPE = 4) 1 time/week 45-min run (RPE = 3)
Zone 2 (~10% of volume) 1 workout per week	3 x 5-min intervals 1:1½ work:rest ratio 60-min workout with long warm-up and cool-down	4 x 5-min intervals 1:1½ work:rest ratio 70-min workout with long warm-up and cool-down	5 x 5-min intervals 1:1½ work:rest ratio 75-min workout with long warm-up and cool-down	2 x 8-min intervals 1:2 work:rest ratio 60-min workout with long warm-up and cool-down
Zone 3 (~10% of volume) 1 workout per week	2 sets: 3 x 60-second intervals 1:3 work:rest ratio 10 min between sets 60-min workout with long warm-up and cool-down	3 sets: 3 x 45-second intervals 1:3 work:rest ratio 10 min between sets 70-min workout with long warm-up and cool-down	3 sets: 3 x 60-second intervals 1:3 work:rest ratio 10 min between sets 75-min workout with long warm-up and cool-down	2 sets: 3 x 30-second intervals 1:3 work:rest ratio 10 min between sets 45-min workout with long warm-up and cool-down
Strength Training	Circuit training 2 days/week 1 hour/session	Circuit training 2 days/week 1 hour/session	Circuit training 2 days/week 1 hour/session	Circuit training 1–2 days/week 1 hour/session

If the client begins showing signs of overtraining (e.g., increased RHR, disturbed sleep, or decreased hunger on multiple days), the health coach should decrease the frequency and/or intensity of the client's intervals and provide more time for recovery. Also, if the client cannot reach the desired intensity during an interval, or is unable to reach the desired recovery intensity or heart rate during the recovery interval, the interval session should be stopped and the client should recover with cardiorespiratory exercise at an RPE of 3, and no more than 4, to prevent overtraining.

Phase 4: Anaerobic-power Training

The fourth phase of the ACE IFT Model for cardiorespiratory training focuses on anaerobic power. Only highly fit and competitive clients with very specific goals related to high-speed performance during endurance events will require exercise programming in phase 4. Some examples of athletes that might perform phase 4 training include track and road cyclists who compete in events that require repeated sprinting and recovery throughout the race and during the final sprint finish, competitive kayakers who need to paddle vigorously for short periods to navigate through difficult sections of rapids, and cross-country runners who need to be able to repeatedly surge up and recover following multiple hills during the course of a race.

This anaerobic-power training phase can essentially be thought of as strength training, although it is specific to the mode of activity (e.g., running or cycling). The intent is to perform very high-intensity training of nearly maximal muscular capacity, but with enough recovery to prevent the rapid accumulation of fatigue, so that the muscular system can be taxed maximally.

This is very specialized training intended to be performed by individuals preparing for competition. It is intended to increase the tolerance for the metabolic by-products of high-intensity exercise, including exercise performed at intensities greater than $\dot{V}O_2$max. Since this kind of training is very uncomfortable and, in older individuals, potentially dangerous, it should be performed only after a long period of training accommodation.

Program Design for Phase 4: Anaerobic-power Training

Most clients will never reach phase 4 training, as only clients with very specific goals for achieving high sprinting speed and/or short bursts of very high levels of power for challenges such as short hills, will require anaerobic-power training. Some health coaches who work with more highly competitive clients may work with several clients per year who train in phase 4, while others may not work with anyone in phase 4 for several years. Even elite athletes will only spend part of a given year performing phase 4 training cycles to prepare for specific competitions.

Obviously, this kind of training is only designed for individuals interested in competition, and can be tolerated only on a limited basis. Examples might include 6 x 100-meter acceleration runs, where the middle 40 meters are performed at absolute maximal intensity. There might be five minutes of recovery between runs, allowing for full recovery. This type of training should not generally be viewed as cardiorespiratory training. It is entirely supplemental and designed for muscular accommodation.

The total weekly exercise program for a client training in phase 4 will look similar to a client training in phase 3, with 70 to 80% of the training time in zone 1, approximately 10% to 20% of training in zone 3, and only brief periods (less that 10%) in zone 2. The difference will be in the types of intervals performed during some of the zone 3 workout time. Intervals for the phase

4 client will be very short sprints or hill sprints designed to tax the **phosphagen** stores in the muscles and create a rapid rise in blood **lactate** levels. These short, highly intense intervals (RPE of 9 to 10) will be followed by long recovery intervals that may be 10 to 20 times longer than the work intervals. For example, a client could perform 5 x 10-second accelerations while cycling on a relatively flat road with little traffic, with each acceleration followed by a 2- to 3-minute recovery interval (10-second work interval with 120- to 180-second recovery interval). These anaerobic-power intervals are supplementary to the full training program performed by a client who has endurance-performance goals. As such, these intervals should be performed only once per week as a complement to the full endurance-training program.

Functional Movement and Resistance Training Based on the ACE IFT Model

There are two essential prerequisite stages to training clients that are frequently overlooked. Traditional training focuses on strengthening muscles or improving their endurance capacity in isolation and generally disregards the relationship of the entire kinetic chain (stability-mobility relationship) with reference to postural alignment of the joints. Health coaches should always emphasize these two stages (ACE IFT Model phases 1 and 2) during the initial portion of a client's training program to "straighten the body before strengthening it," and restore good joint alignment and muscle balance across joints. Good joint alignment facilitates effective muscle action and joint movement, serving as the platform from which good exercise technique is built. Given the complexity of current exercise equipment and the advanced nature of many exercises, health coaches must stress the importance of learning how to perform the five primary movement patterns correctly, as they represent the foundation to all movement (see Figure 17-23, page 503). Proper execution of these movements enhances the potential to promote movement efficiency, as well as long-term maintenance and integrity of the joint structures, muscles, connective tissues, and nerves of the musculoskeletal system.

Once the functional aspects of movement have been adequately addressed, clients can progress on to resistance training with increasing weightloads. Strength training improves the client's fitness level by placing emphasis on muscle force production and manipulating the variables of training to address a variety of specific exercise goals. For many clients, phase 3 (load training) will be the final phase they will reach in their exercise programming, as phase 4 (performance training) of the ACE IFT Model involves training techniques and methods designed to enhance athletic performance. While a number of clients will welcome the challenge of incorporating athletic-training techniques into their programs for variety and possibly improved performance in team or individual competitions, many clients will not want to take this extra step.

Phase 1: Stability and Mobility Training

Strengthening muscles to improve posture should initially focus on placing the client in positions of good posture and begin with a series of low-grade isometric contractions [<50% of maximal effort or **maximum voluntary contraction (MVC)**], with the client completing two to four repetitions of five to 10 seconds each. The goal is to condition the postural (tonic) muscles that typically contain greater concentrations of **type I muscle fibers** with volume as opposed to intensity (Kendall et al., 2005). Higher intensities that require greater amounts of force will generally evoke faulty recruitment patterns. The exercise volume can be gradually increased (overload) to improve strength and endurance, and to reestablish muscle balance at the joints.

Because many deconditioned individuals lack the ability to stabilize the entire kinetic chain, the initial emphasis should be placed on muscle isolation using supportive surfaces and devices (e.g., floor, wall, or chair backrest) prior to introducing integrated (whole-body, unsupported) strengthening exercises. For example, to help a client strengthen the **posterior** deltoids and rhomboids, which are associated with forward-rounded shoulders, a health coach could start by having the client perform reverse flys in a **supine** position, isometrically pressing the backs of the arms into the floor, rather than sets of dynamic high-back rows using external resistance. The use of support offers the additional benefit of kinesthetic and visual feedback, which is critical to helping clients understand the alignment of specific joints (e.g., when lying on the floor, the individual can feel and see the contact points with the floor when joints are placed in ideal postural positions). The strengthening exercises should ultimately progress to dynamic movement, initially controlling the ROM to avoid excessive muscle lengthening before introducing full-ROM movement patterns. An important concept to keep in mind is that while a muscle may be strong in a lengthened position, it needs strength at a normal and healthy resting length (Lieber, 2009; MacIntosh, Gardiner, & McComas, 2006; Williams & Goldspink, 1978). For example, to strengthen the rhomboids using more dynamic movements, the client should hold the scapulae in a good postural position and avoid scapular **protraction** and **retraction** during the movement. Dynamic strengthening exercises for good posture do not involve heavy loads, but rather volume training to condition the type I fibers. Consequently, health coaches should plan on one to three sets of 12 to 15 repetitions when introducing dynamic strengthening exercises. To summarize, the strengthening of weakened muscles follows a progression model beginning with two to four repetitions of isometric muscle contractions, each held for five to 10 seconds at less than 50% of MVC in a supported, more isolated environment. The next progression is to dynamic, controlled ROM exercises incorporating one to three sets of 12 to 15 repetitions.

Addressing Mobility Needs in the Obese Population

Many of the stability and mobility exercises presented in the following sections require the client to lie down or sit on the floor. This can be challenging for obese clients who find it difficult to transition from standing to lying or sitting on the floor, and vice versa. Painful joints or other musculoskeletal problems combined with increased body mass might make performing floor-based exercises a poor choice for obese clients. Alternatively, floor exercises can be performed on an elevated platform or on a sturdy athletic training table. These options allow obese clients to perform the necessary movements while lying down or being seated without the uncomfortable, and perhaps intimidating, task of transitioning to the floor. Health coaches who consistently work with obese clients should make an effort to obtain some type of elevated exercise surface for this special population.

Proximal Stability: Activating the Core

The goal of functional movement and resistance training is to promote stability of the lumbar spine by improving the reflexive function of the core musculature that essentially serves to stabilize this region during loading and movement. The core functions to effectively control the position and motion of the trunk over the pelvis, which allows optimal production, transfer, and control of force and motion to more distal segments during whole-body movements (Willardson, 2007; Kibler, Press, & Sciascia, 2006). The term "core" generally refers to the muscles of the lumbo-pelvic region, hips, abdomen, and lower back. Table 17-8 provides guidelines for exercise progression for core activation when a client is lying supine (Figure 17-3). Table 17-9 provides an exercise progression for core stabilization when a client is on the hands-and-knees (Figure 17-4).

Table 17-8

Exercise Progression for Core Activation

Pelvic floor contractions ("Kegels," or the contraction to interrupt the flow of urine)	Perform 1–2 sets x 10 repetitions with a 2-second tempo, 10–15 second rest intervals between sets
TVA contractions (drawing the belly button toward the spine)	Perform 1–2 sets x 10 repetitions with a 2-second tempo, 10–15 second rest intervals between sets
Combination of both contractions	Perform 1–2 sets x 10 repetitions with a 2-second tempo, 10–15 second rest intervals between sets
Contractions with normal breathing	Perform 1–2 sets x 5–6 repetitions with slow, 10-second counts while breathing independently, 10–15 second rest intervals between sets Progress to 3–4 sets x 10–12 repetitions, each with a 10-second count, 10–15 second rest intervals between sets

Note: TVA = Transverse abdominis

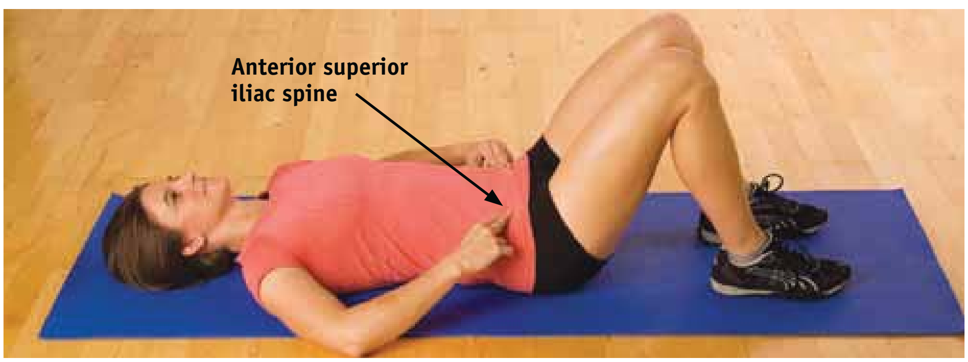


Figure 17-3
Supine drawing-in body position

a.

b.

Figure 17-4
Quadruped drawing-in with extremity movement

Table 17-9	
Exercise Progression for Core Stabilization	
1. Raise one arm 0.5 to 1 inch (1.25 to 2.5 cm) off the floor and perform the sequence of controlled shoulder movements: • 6–12 inch (15–30 cm) sagittal plane shoulder movements (flexion/extension) • 6–12 inch (15–30 cm) frontal plane shoulder movements (abduction/adduction) • 6–12 inch (15–30 cm) transverse plane shoulder movements (circles or circumduction)	Perform 1–2 sets x 10 repetitions with a 2-second tempo, use 10–15 second rest intervals between sets
2. Raise one knee 0.5 to 1 inch (1.25 to 2.5 cm) off the floor and perform the sequence of controlled hip movements: • 6–12 inch (15–30 cm) sagittal plane hip movements (flexion/extension) • 6–12 inch (15–30 cm) frontal plane hip movements (abduction/adduction) • 6–12 inch (15–30 cm) transverse plane hip movements (circles)	Perform 1–2 sets x 10 repetitions with a 2-second tempo, use 10–15 second rest intervals between sets
3. Raise contralateral limbs (i.e., one arm and the opposite knee) 0.5 to 1 inch (1.25 to 2.5 cm) off the floor and perform the sequence of movements: • Repeat the above movements in matching planes (i.e., simultaneous movement in the same plane with both limbs) or alternating planes (i.e., mixing the planes between the two limbs). • This contralateral movement pattern mimics the muscle-activation patterns used during the push-off phase portion of walking and is an effective exercise to train this pattern.	Perform 1–2 sets x 10 repetitions with a 2-second tempo, use 10–15 second rest intervals between sets

Proximal Mobility: Hips and Thoracic Spine

Improving mobility of the two joints immediately adjacent to the lumbar spine is the focus of proximal mobility. Based on observations made during the postural assessment and movement screens, limitations in mobility within these two areas in any of the three planes should become the focus. Health coaches should follow some fundamental principles when programming to improve mobility in these body regions:

- Although these two regions should exhibit good mobility in all three planes, they are typically prone to poor mobility. Consequently, some static stretching to improve muscle flexibility (or extensibility) should precede dynamic mobilization exercises.
- When attempting to improve muscle flexibility or joint mobility, clients must avoid undesirable or compensated movements at successive joints (e.g., avoid any increases in lumbar lordosis associated with a tight latissimus dorsi muscle during an overhead stretch).
- Because the body may lack the ability to effectively stabilize the entire kinetic chain, supportive surfaces should be utilized while promoting mobility (e.g., floor, benches, and backrests).
- Because muscles contribute to movement in all three planes, health coaches should incorporate flexibility exercises that lengthen the muscles of the hips and thoracic spine in all three planes.

Figures 17-5 through 17-9 present exercises that promote mobility of the hips, while Figures 17-10 and 17-11 present exercises that promote mobility of the thoracic spine.

a.

b.

Figure 17-5

Cat-camel

Objective: To improve extensibility within the lumbar extensor muscles

Preparation and position:

- Assume the quadruped position with the hands positioned directly under the shoulders (shoulder-width apart) and the knees positioned directly under the hips (hip-width apart).
- Engage the core muscles to create a neutral spine in this starting position.
- The elbows should remain extended throughout the exercise.

Exercise:

- From this starting position, exhale slowly while contracting the abdominals [draw the belly button toward the spine (i.e., "hollowing")], gently pushing and rounding the entire back upward. Drop the head, bringing the chin toward the chest (a).
- Hold this position for 15 seconds.
- Slowly inhale, relax, and return to the starting position, but allow the stomach and spine to sag toward the floor. Allow the shoulders to collapse (adduct) toward the spine, and tilt the head upward (b).
- Hold this position for 15 seconds.
- Perform two to four repetitions.


a.

b.

Figure 17-6
Pelvic tilts

Objective: To improve hip mobility in the sagittal plane

Preparation and position:

- Lie supine with the knees bent and the feet placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Abduct the arms to shoulder height, resting them on the floor with the arms externally rotated (palms facing upward) (a).

Exercise:

- Slowly contract the abdominals to tilt the pelvis posteriorly, hold briefly, relax and then contract the erector spinae muscles and hip flexors to tilt the pelvis anteriorly (b).
- Perform one or two sets of five to 10 controlled repetitions, holding the end position for one or two seconds with 30-second rest intervals between sets.


a.


b.

Figure 17-7
Hip flexor mobility: Lying hip flexor stretch

Objective: To improve mobility of the hip flexors in the sagittal plane without compromising lumbar stability

Preparation and position:

- Lie supine with the knees bent and the feet placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.

Exercise:

- Reach both hands behind one knee and gently pull the knee toward the chest (a).
- Slowly extend the opposite leg until it is either fully extended or lumbar stability is compromised (b).
- Perform two to four repetitions per side, each for a minimum of 15 seconds.

a.

b.

c.

Figure 17-8

Hamstrings mobility: Lying hamstrings stretch

Objective: To improve mobility of the hamstrings in the sagittal plane without compromising lumbar stability

Preparation and position:

- Lie supine inside a door jamb or beside a sturdy table with one knee bent and the foot placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Engage the core muscles to stabilize the lumbar spine in the neutral position, and maintain this position throughout the exercise.
- Raise the opposite leg to rest it on the table or door jamb with slight flexion in the knee and plantarflexion at the ankle (to remove any limitation from the gastrocnemius during the stretch) (a).

Exercise:

- Exhale and slowly extend the raised leg, stretching the hamstrings.
- The objective is to promote hamstrings flexibility with the extended leg positioned at an 80- to 90-degree angle with the floor.
- Perform two to four repetitions per side, each for a minimum of 15 seconds.

Progression: Perform a series of pelvic tilts, holding the anterior pelvic tilt to increase the magnitude of he stretch (b).

Progression: Extend the lower leg for the duration of the stretch without compromising lumbar stability (c).

Figure 17-9

Hip mobilization: Supine 90-90 hip rotator stretch

Objective: To improve hip mobility in the transverse plane

Preparation and position:

- Lie supine with both feet placed against a wall, with an approximately 90-degree bend at the knees and 60 to 80 degrees of flexion at the hips (a).
- Cross one leg over the opposite knee, resting that ankle on the knee.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.
- Place one hand on the crossed knee.

Exercise:

- Exhale and gently push the crossed knee away from the body while simultaneously lifting the opposite foot off the wall, increasing the degree of hip flexion (b).
- Perform two to four repetitions per side.
- Hold each stretch for a minimum of 15 seconds.

Progression: Assume the quadruped position, crossing the lower part of the left leg over the right leg (externally rotating the left leg). Position the left arm 1 to 2 feet (30 to 61 cm) out to the side of the body (c). Slowly lean the body out to that side, supporting the weight on the outspread hand (d). Perform two to four repetitions per side and hold each stretch for a minimum of 15 seconds (Tumminello, 2007).

Progression: Assume the quadruped position, engaging the core muscles to stabilize the lumbar spine. Lift the left leg slightly, extend it backward while sliding it across the right leg and behind the body, and drop the hips toward the floor during the movement while avoiding hip rotation (e) (Tumminello, 2007). Perform one or two sets of five to 10 controlled repetitions per side, holding the end range of motion for one or two seconds, with 30-second rest intervals between sets.

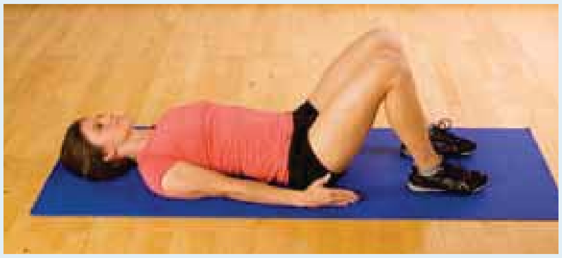
a.

b.

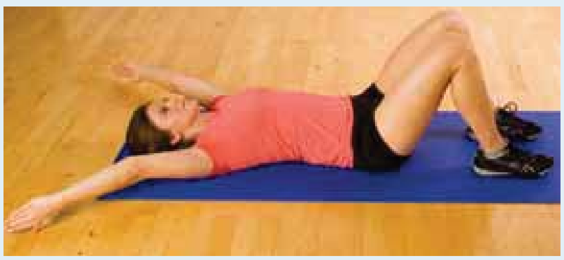
c.

d.

e.


a.


b.


c.


d.

Figure 17-10

Thoracic spine (T-spine) mobilization exercises: Spinal extensions and spinal twists

Spinal Extensions

Objective: To promote thoracic extension

Preparation and position:

- Lie supine with the knees bent and feet placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Position the arms at the sides with elbows extended.
- Engage the core muscles to stabilize the lumbar spine (avoiding increased lordosis during the exercise) and maintain this contraction throughout the exercise.
- Depress and retract the scapulae while stabilizing the low back (a).

Exercise:

- Exhale and slowly flex the shoulders, raise both arms overhead, and attempt to bring both hands to touch the floor overhead ("I" position) (b). Since the arms tend to internally rotate during shoulder flexion, and shrugging of the shoulders often occurs, attempt to depress the scapulae and keep the arms in a neutral or externally rotated position.
- Slowly return to the starting position.
- Perform one or two sets of five to 10 controlled repetitions, holding the end range of motion for one to two seconds, with 30-second rest intervals between sets.
- Repeat the entire movement from the starting position, but move into a "Y" formation, abducting the arms to 135 degrees (c).
- Repeat the entire movement from the starting position, but move in a "T" formation, sliding the arms along the floor and abducting them to 90 degrees (d).
- Repeat the entire movement from the starting position, but, with the elbows bent, move in a "wiper formation," sliding the arms along the floor from the sides to an overhead position.

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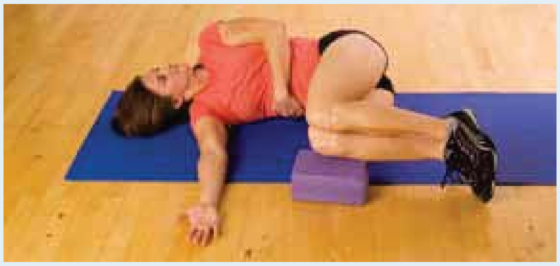

e.


f.


g.


h.

Spinal Twists

Objective: To promote trunk rotation, primarily through the thoracic spine with some lateral hip mobility

Preparation and position:

- Lie on one side, bending both knees to 90 degrees, flexing the hips to 90 to 100 degrees, and aligning both knees together, resting them on a ball or riser. Keep the lower knee on the ball or riser throughout this first exercise progression and keep both knees aligned. Engage the core muscles to stabilize the lumbar spine (avoiding increased lordosis) and maintain this contraction throughout the exercise.
- Reach the upper arm across and in front of the body, grasping the ribcage on the opposite side of the trunk (e).

Exercise:

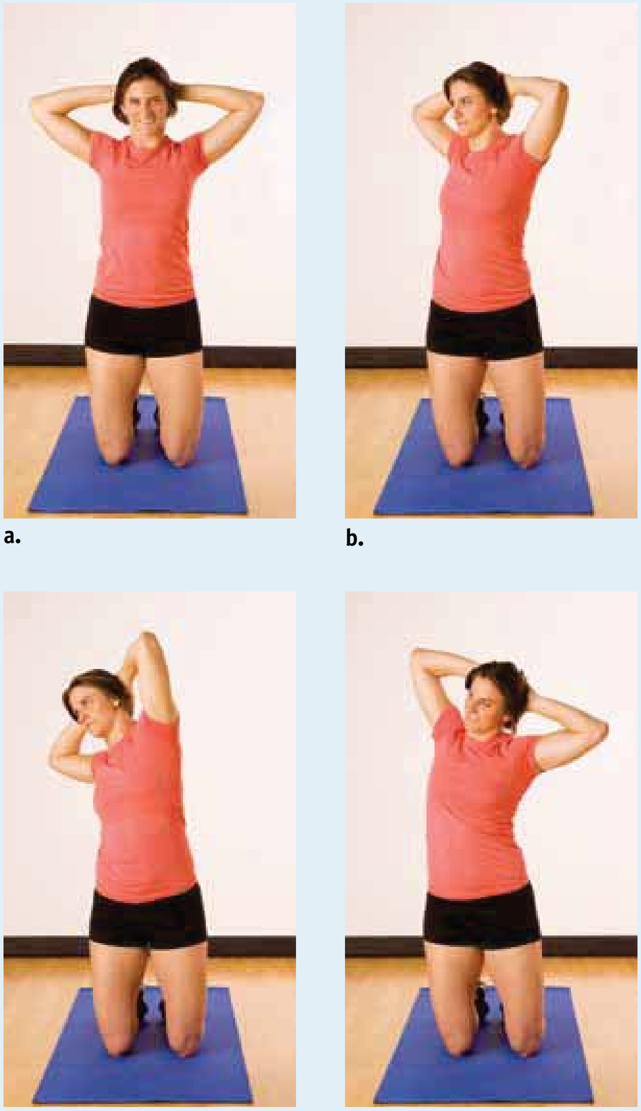
- Exhale and slowly rotate the torso by pulling on the ribcage. Attempt to avoid any rotational movement of the hips and knees.
- Perform two to four repetitions to each side.
- Hold each pull for 15 to 30 seconds.

Progression: Repeat the same stretch, but place a squeezable object (e.g., a soft ball or yoga block) between the knees, positioning the lower knee on the floor.

Progression: Repeat the same stretch, but extend the lower leg and rest the inside of the upper knee on a squeezable object.

Progression: Repeat the same stretch, but change the upper arm from the rib-grab position to abducting the arm to 90 degrees with an extended elbow, and attempt to bring the upper arm down to touch the floor (f).

Progression—push-pull: Assume any of the starting positions for the lower extremity on one side. Depress and retract both scapulae, then move the upper arm to the start position of a press movement (e.g., bench press), while the lower arm moves into the start position of a pull movement (without protracting the scapula) (g & h). Simultaneously perform an upward press with the upper arm and a high-back row with the lower arm. Perform one or two sets of five to 10 controlled repetitions per side, holding the end range of motion for one or two seconds, with 30-second rest intervals between sets.



a. b. c. d.

Figure 17-11

Thoracic spine (T-spine) mobilization: Prisoner rotations

Objective: To promote thoracic spine mobility in the transverse plane

Preparation and position:

- Assume a kneeling position and interlock the hands lightly behind the head without pulling the head forward into neck flexion (a).
- Engage the core muscles to stabilize the lumbar spine, and maintain this contraction throughout the exercise.
- The exercise objective is to promote trunk rotation, primarily within the thoracic spine without rotating the hips.

Exercise:

- Exhale and slowly rotate the arms to the right until a point of resistance is reached (no bouncing movement) (b). Avoid rotating the hips.
- Hold this position for 15 seconds and then laterally flex the trunk, pointing the right elbow toward the floor (c). Hold this position for five seconds.
- Return to an upright position and then laterally flex in the opposite direction (d). Hold this position for five seconds.
- Return to the upright position and allow the trunk to rotate further into the movement.
- Perform two to four repetitions to each side.

Source: Tumminello, N. (2007). *Warm-up Progressions—Volumes 1 and 2*. Baltimore, Md.: Performance University.

Proximal Stability of the Scapulothoracic Region and Distal Mobility of the Glenohumeral Joint

Improving stability within the scapulothoracic region during upper-extremity movements (e.g., push- and pull-type motions), while promoting movement at the glenohumeral joint, is an important focus of exercises for the shoulder and shoulder girdle. The glenohumeral joint is a highly mobile joint and its ability to achieve this degree of movement is contingent upon the stability of the scapulothoracic region (i.e., the ability of the scapulae to maintain appropriate proximity against the ribcage during movement) (Houglum, 2010; Sahrmann, 2002). It is the synergistic actions of muscle groups working through **force-couples** in this region that help achieve this stability, considering that the scapulae only attach to the **axial skeleton** via the clavicle. Promoting stability within this joint, therefore, requires muscle balance within the force-couples of the joint. Additionally, as many of these muscles also cross the glenohumeral joint, they require substantial levels of mobility. This implies that a program promoting scapulothoracic stability may need to include stretches to promote extensibility of both the muscle and joint structures. Therefore, static stretches to improve tissue extensibility should precede dynamic movement patterns and strengthening exercises.

To enhance tissue extensibility, clients can employ several different stretching modalities. Myofascial release using a stick or foam roller—moving across the tender spots—will help realign the elastic fibers and reduce hypertonicity (see page 459 for more information on myofascial release) (Barnes, 1999). This should precede static stretching of the shoulder capsule and of specific muscles of the scapulae. When stretching the shoulder capsule with a client, health coaches must address the **inferior**, posterior, anterior, and **superior** components.

- Stretch the inferior capsule using an overhead triceps stretch (Figure 17-12).
- Stretch the posterior capsule by bringing the arm across and in front of the body (Figure 17-13a). An alternative position for this stretch is to stand adjacent to a wall, flexing the arm in front of the body to 90 degrees and resting the full length of the arm against the wall (Figure 17-13b), then slowly rotate the trunk inward toward the wall (Figure 17-13c). Since this movement also produces scapular abduction, and since it is common for clients to have abducted scapulae as a postural deviation, it should be a minimal focus during shoulder stretching.
- Stretch the anterior capsule using a pectoralis stretch (Figure 17-14).
- Stretch the superior capsule by placing a rolled-up towel 2 inches above the elbow against the trunk (bent-elbow position at the side of the body), grasping the base of the elbow and pulling it downward and inward (Figure 17-15).

Figure 17-12
Overhead triceps stretch

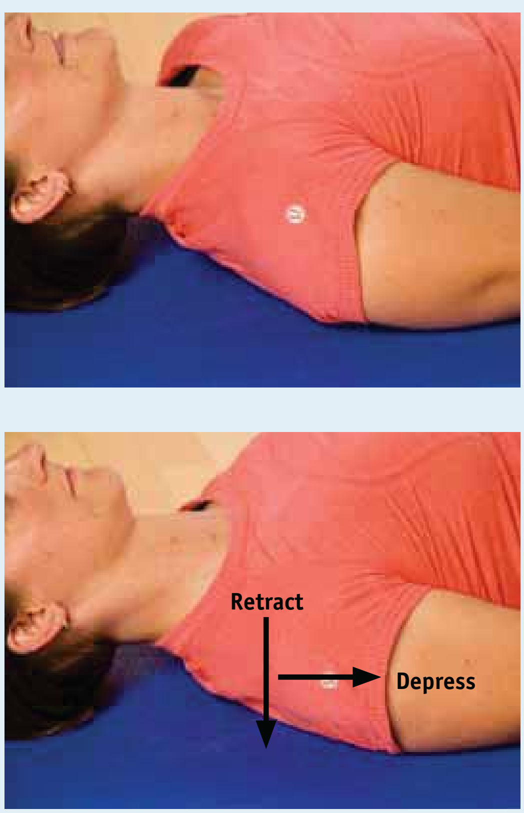
a. b. c.

Figure 17-13
Posterior capsule stretches

Figure 17-14
Anterior capsule (pectoralis) stretch

Figure 17-15
Superior capsule stretch

One important consideration for promoting scapulothoracic stability revolves around the type of exercises selected (i.e., closed-chain or open-chain exercises). During **closed kinetic chain (CKC)** movements where the distal segment is more fixed (e.g., pull-ups and push-ups), a key role of the serratus anterior is to move the thorax toward a more fixed, stable scapulae (Houglum, 2010; Cook & Jones, 2007a). During **open kinetic chain (OKC)** movements (e.g., front raises and side lateral raises), however, a key role of the serratus anterior is to control movement of the scapulae about the ribcage (Houglum, 2010; Cook & Jones, 2007a). CKC movements are generally considered more functional, as they mimic daily activities closely. CKC exercises load and compress joints, increasing kinesthetic awareness and **proprioception,** which translates into improved parascapular and shoulder stability (Cook & Jones, 2007a). Isolated OKC exercises, on the other hand, are not as effective in restoring coordinated parascapular control. One challenge with CKC exercises is that many are too challenging for deconditioned individuals. Thus, it is important to initially use the floor to provide kinesthetic feedback as the client lies supine and OKC movements to improve control and movement efficiency and increase kinesthetic awareness of shoulder position. Health coaches can start by first helping the individual recognize the normal resting position of the scapulae kinesthetically (i.e., feel the correct scapulae position against the floor). The exercise presented in Figure 17-16 helps achieve this awareness by instructing the client on how to "pack" the scapulae.



b.

Figure 17-16

Shoulder packing

Objective: To kinesthetically improve awareness of good scapular position, improving flexibility and strength of key parascapular muscles

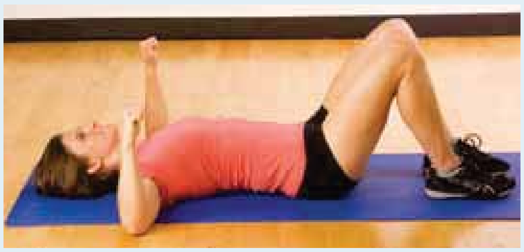
Preparation and position:

- Lie supine on a mat with knees bent to 90 degrees and the feet placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Position the arms at the sides of the trunk with the palms facing upward.
- Engage the core muscles to stabilize the lumbar spine in the neutral position. Maintain this position throughout the exercise (a).

Exercise:

- Exhale and perform two to four repetitions of each of the following, holding each contraction for five to 10 seconds (b):
  - ✓ Scapular depression
  - ✓ Scapular retraction
- Using passive assistance from the opposite arm, gently push down on the shoulder (posterior tilt on scapula) without losing lumbar stability. Hold this position for 15 to 60 seconds.
- Relax and repeat two to four times on each shoulder.

A variety of exercises can be used to condition the rotator cuff muscles, but whichever exercises are selected, the client must perform them from the packed shoulder position. Figures 17-17 through 17-20 provide examples of OKC and CKC rotator cuff exercises that promote scapulothoracic stability.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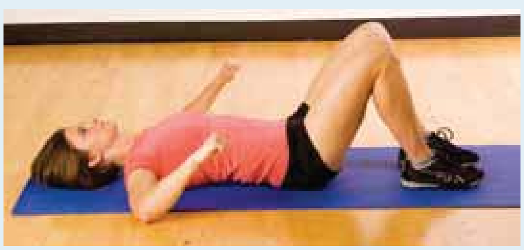
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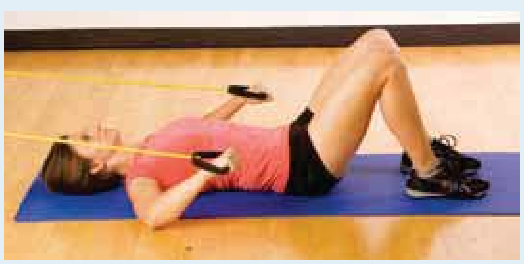
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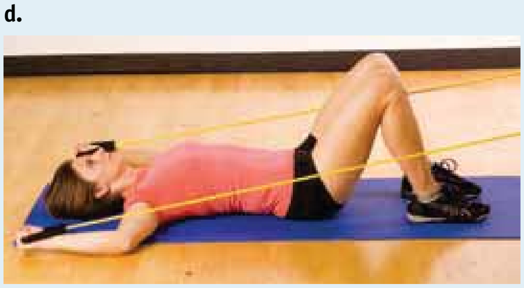

e.

Figure 17-17
Internal and external humeral rotation

Objective: To improve rotator cuff function while maintaining good scapular position

Preparation and position:

- Lie supine on a mat with knees bent and feet placed flat on the floor, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.
- Pack both scapulae and maintain this position throughout the exercise.
- Abduct the arms to 90 degrees (shoulder height), resting the backs of the upper arms on the mat, and bend the elbows 90 degrees so that the forearms are perpendicular to the floor (a).

Exercise:

- *External rotation:* Slowly externally rotate the arms backward, bringing the forearms toward the floor. The ultimate goal is to achieve movement so that the back of the forearms rest on the floor (90 degrees of movement) (b).
- Hold this position for 15 to 60 seconds and repeat two to four times.
- *Internal rotation:* From the starting position, internally rotate the arms forward, bringing the forearms toward the floor. The ultimate goal is to achieve movement so that the forearms reach an angle of 20 to 30 degrees above the floor (60 to 70 degrees of movement) (c).
- Hold this position for 15 to 60 seconds, and repeat two to four times.

Progression: Once the end ranges can be reached, add resistance to condition these muscles (d & e). Remember, these are small muscles with higher concentrations of type 1 fibers, so they respond best to volume training. Add no more than 5 pounds (2.3 kg) of external resistance (cable or dumbbell) and build volume toward three sets of 12 to 15 repetitions with 30-second rest intervals between sets.

a.

b.

Figure 17-18

Reverse flys with supine 90-90

Objective: To strengthen the posterior muscles of the shoulder complex

Preparation and position:

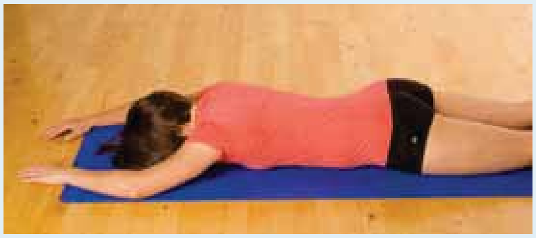
- Lie supine on the floor with both legs draped over a chair or riser. The height of the chair or riser should allow the knees and hips to flex to 90 degrees without elevating the hips off the floor.
- Align the anterior superior iliac spine (ASIS) with the knee and second toe and use supports to hold the feet in this position (e.g., pillows), preventing any external or internal rotation of the feet and lower legs, which would alter pelvic and low-back position.
- Abduct the arms to 90 degrees (shoulder height), resting the backs of the upper arms on the mat and bending the elbows 90 degrees so that the forearms are perpendicular to the floor.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise (a).
- Pack both scapulae and maintain this position throughout the exercise.

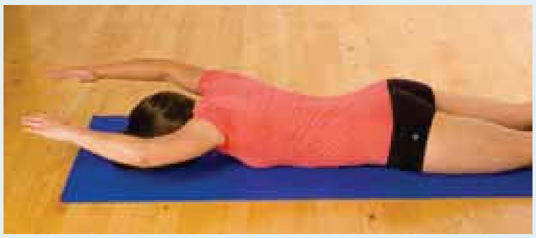
Exercise:

- Exhale and press the back of the arms into the floor with less than 50% of maximum voluntary contraction, without altering the position of the lumbar spine.
- Perform two to four repetitions, holding each isometric contraction for five to 10 seconds.

Progression: Lying supine, build exercise volume toward three sets of 12 to 15 repetitions, with 30-second rest intervals between sets.

Progression: Seated with the back flat against a wall and knees bent, perform three sets of 12 to 15 repetitions, with 30-second rest intervals between sets. Maintain contact between the sacrum, low back, scapulae, and back of the head and the wall (b).


a.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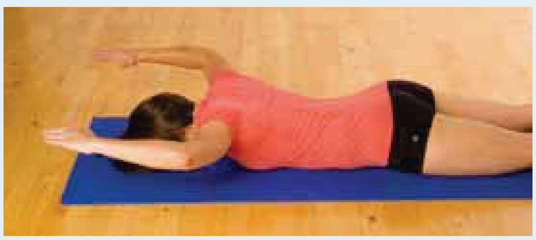
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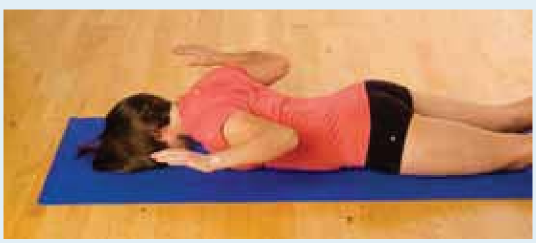
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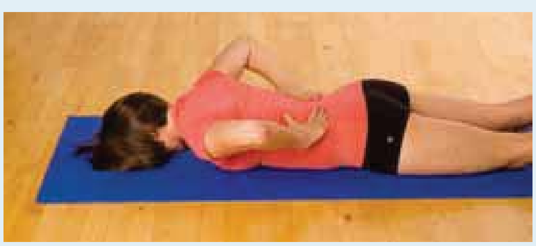

e.

Figure 17-19
Prone arm lifts

Objective: To strengthen the parascapular muscles

Preparation and position:

- Lie prone on a mat with both legs extended and arms positioned overhead with bent elbows, resting the back of the upper arms on a mat.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.
- Pack both scapulae and maintain this position throughout the exercise (a).

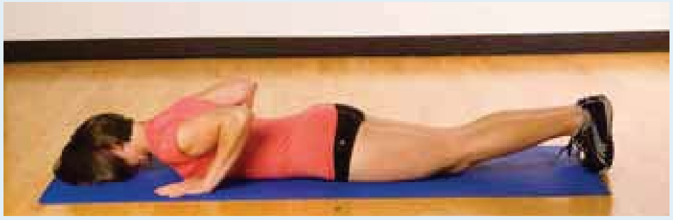
Exercise:

- *"I" formation:* Exhale and lift both arms 2 to 4 inches (5 to 10 cm) off the floor (keeping the elbows bent), while maintaining a depressed scapular position (avoiding scapular elevation) (b).
- Perform two to four repetitions, holding each repetition for five to 10 seconds.
- *"Y" formation:* Slide both arms out to a 135-degree position, keeping the elbows bent, but resting the arms on the mat (forming the letter "Y"). Exhale and lift both arms 2 to 4 inches (5 to 10 cm) off the floor while maintaining a depressed scapular position (avoiding scapular elevation) (c).
- Perform two to four repetitions, holding each repetition for five to 10 seconds.
- *"W" formation*: Slide both arms out to 90 degrees (shoulder height), resting the arms on the mat (forming the letter "W"). Exhale and lift both arms 2 to 4 inches (5 to 10 cm) off the floor while maintaining a depressed scapular position (avoiding scapular elevation) (d).
- Perform two to four repetitions, holding each repetition for five to 10 seconds.
- *"O" formation:* Reach behind the back and interlock the fingers, if possible, forming a giant letter "O" on the back, resting both forearms on the back. Exhale and lift both arms 2 to 4 inches (5 to 10 cm) off the back, while maintaining a depressed scapular position (avoiding scapular elevation) (e).
- Perform two to four repetitions, holding each repetition for five to 10 seconds.

Progression: Repeat the "I", "Y," and "W" formations with fully extended arms (note that the "W" formation becomes a "T" formation with the arms fully extended). Build the exercise volume toward three sets of 12 to 15 repetitions with 30-second rest intervals between sets. These exercises can ultimately be progressed to an incline position on a stability ball, standing, or in a hip-hinge or forward-bending position (hips flexed 90 degrees).

Figure 17-20

Closed kinetic chain weight shifts



a.

b.

c.

d.

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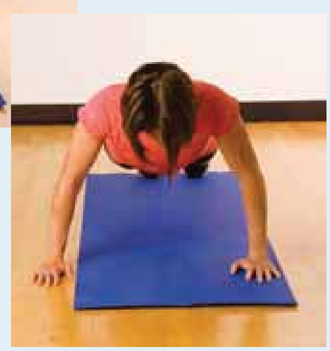

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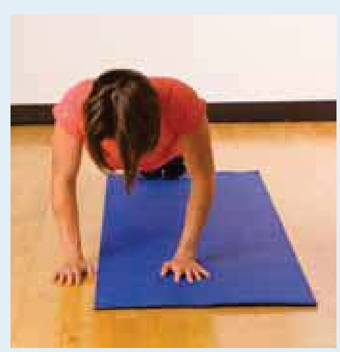


g.

Objective: To stabilize the scapulothoracic joint and lumbar spine in a closed kinetic chain (CKC) position

Preparation and position:

- Lie prone on a mat, placing the hands directly under the shoulders and extending both legs.
- Engage the core muscles to stabilize the lumbar spine in the neutral position. Maintain this position throughout the exercise.
- Pack the shoulders (see Figure 17-16) and maintain this position throughout the exercise (a).
- Press the body upward to assume a full or bent-knee press-up position (b).

Exercise:

- Slowly shift the body weight 3 to 6 inches (8 to 15 cm) forward without moving the hands (c).
- Perform two to four repetitions, holding each for five to 10 seconds.

Progression: Offset one hand into a staggered position by moving it 6 to 12 inches (15 to 30 cm) forward of the shoulder and repeat the movement (d). Perform two to four repetitions, holding each for five to 10 seconds. Repeat to the opposite side.

Progression: Drop the shoulder of the hand positioned under the shoulder toward the floor (e). Perform one or two sets of five to 10 repetitions to each side.

Progression: Perform side shuffles, moving the hands 6 to 12 inches (15 to 30 cm) side-to-side (f & g). Perform one or two sets of five to 10 repetitions to each side.

Distal Mobility

Within the distal segments of the body, the gastrocnemius and soleus muscles (triceps surae) are often problematic, exhibiting tightness and limited mobility. During a squatting movement, many individuals demonstrate a lack of adequate ankle dorsiflexion and are unable to keep their heels down during the lowering phase. An individual who is unable to keep the heels down during a squat movement will need to improve ankle mobility and calf flexibility, which will promote stability within the foot (if he or she stands in a pronated position).

After reestablishing flexibility within the calf muscles through myofascial release and static stretching techniques, individuals can progress to performing the dynamic ankle mobilization exercise presented in Figure 17-21, which mimics the ankle's role during walking and running activities (Gray & Tiberio, 2007).

a.

b.

Figure 17-21

Standing ankle mobilization

Objective: To promote ankle mobility during a dynamic movement pattern

Preparation and position:

- Remove shoes and stand in front of a wall with the feet placed a few inches apart. Lean forward and support the upper extremity with the arms by placing the hands on the wall while stretching the calf muscles.
- Engage the core muscles to stabilize the lumbar spine in the neutral position. Maintain this position throughout the exercise.

Exercise:

- Slowly lift one foot off the ground, flexing the hip and bending the knee close to 90 degrees.
- While stabilizing the body over the stance leg and continuing to lean forward, swing the raised leg across the front of the body in the transverse plane (a), and then swing that same leg back out in the opposite direction (b).
- Perform one or two sets of five to 10 repetitions with each leg, holding each end position for one or two seconds.

Static Balance: Segmental

Movement is essential to complete all **activities of daily living (ADL)**, and the ability to move efficiently requires control of the body's postural alignment or balance. Balance is a foundational element of all programming and should be emphasized early in the training program once core function is established and an individual shows improvements in stability and mobility throughout the kinetic chain. Balance not only enhances physical performance, but also contributes to improving the psychological and emotional states by building self-efficacy and confidence (Rose, 2010). Balance is subdivided into static balance, or the ability to maintain the body's **center of mass (COM),** also called the **center of gravity (COG),** within its **base of support (BOS)**, and **dynamic balance**, or the ability to move the body's COM outside of its BOS while maintaining postural control and establishing a new BOS (Whiting & Rugg, 2006; Shumway-Cook & Woollacott, 2001).

COM represents that point around which all weight is evenly distributed (Kendall et al., 2005). It is generally located about 2 inches (5 cm) anterior to the spine in the location of the first and second sacral joints (S1 and S2), but varies in individuals by body shape, size, and gender, being slightly higher in males due to greater quantities of musculature in the upper body (Rose, 2010; Kendall et al., 2005). A person's COM constantly shifts as he or she changes position, moves, or adds external resistance. BOS is defined as the two-dimensional distance between and beneath the body's points of contact with a surface (Houglum, 2010).

After the client performs exercises to reestablish core function, static balance training, beginning with segmental or sectional stabilization training, can be introduced. This entails the use of specific static-balance exercises performed over a fixed BOS that impose small balance challenges on the body's core. The client adopts a seated position and engages the core musculature. By following the training guidelines and manipulating the variables listed in Table 17-10, health coaches can gradually progress exercises by increasing the balance challenge until the client experiences difficulty in maintaining postural control, yet does not fall (Rose, 2010). The objective with these progressions is to increase the exercise challenge until a threshold of balance or postural control becomes evident, and then continue gradually from that point by manipulating any of the variables.

Table 17-10

Training Guidelines for Static Balance

Training Variables	Training Conditions
2–3 times per week Perform exercises toward the beginning of workouts before the onset of fatigue (which decreases concentration) Perform 1 set of 2–4 repetitions, each for 5–10 seconds	Narrow BOS (e.g., wide to narrow) Raise COM (e.g., raising arms overhead) Shift LOG (e.g., raising arms unilaterally, leaning or rotating trunk) Sensory alteration [e.g., shifting focal point to a finger 12 inches (30 cm) in front of one's face, performing slow hand-eye tracking, or performing slow head movements such as looking up and down] Sensory removal (e.g., closing eyes)

Note: BOS = Base of support; COM = Center of mass; LOG = Line of gravity

After incorporating the variables covered in Table 17-10, health coaches can introduce two more challenging variables, but only if they are considered appropriate and consistent with the client's goals:

- Reduce the points of contact (e.g., move from balancing on two feet to one foot).
- Add additional unstable surfaces (e.g., air discs, Airex™ pad, BOSU®, or Step 360®).

Each of these challenges should be introduced separately, gradually increasing the exercise difficulty by manipulating the variables provided in Table 17-10 under this new challenge. Next, health coaches can introduce the second challenge in a similar manner (e.g., move to one foot and reintroduce the variables listed in Table 17-10 before implementing additional unstable surfaces, which should be introduced with two feet).

Static Balance: Integrated (Standing)

The natural progression from seated exercises is to standing exercises, thereby integrating the entire kinetic chain, which represents more function and mimics many ADL. During integrated movements, the effects of external loads, gravity, and reactive forces all increase, thereby necessitating a greater need to stabilize the spine. McGill (2006) introduced the concept of bracing, explaining how it improves spinal stability by providing a wider BOS. To teach a client how to brace, a health coach can have the client stand in a relaxed position and engage the core muscles. The client can then imagine a person standing in front of him or her who is about to deliver a quick jab to the stomach. In anticipation of the jab, the individual should stiffen up the trunk region by co-contracting both layers of muscles. This represents bracing, which, unlike centering (or drawing in the navel) that acts reflexively, is a conscious contraction used for short time periods during external loading on the spine (e.g., when performing a weighted squat or picking up a box).

The health coach can introduce standing static-balance training on stable surfaces before progressing to static unstable (e.g., air discs, Airex pad, BOSU, or Step 360) or dynamic unstable surfaces (e.g., Coretex®), both of which gradually increase the balance challenge. Both forms of training are important to developing efficiency within the **proprioceptive, vestibular**, and **ocular systems,** but the decision regarding which training surfaces to use depends primarily on the client's needs, capabilities, and goals. Regardless, all balance exercises should ultimately incorporate some form of dynamic balance training on stable surfaces (e.g., movement on the ground) to mimic ADL. When designing static balance-training programs, health coaches should follow the stance-position progressions illustrated in Figure 17-22. The health coach should identify which stance position challenges the client's balance threshold and then repeat the exercises with progressions outlined in Table 17-10.

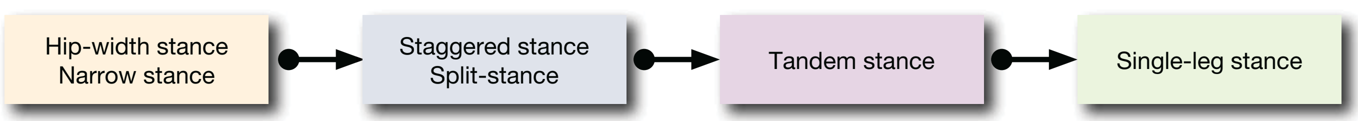


Figure 17-22
Stance-position progressions

Phase 2: Movement Training

While phase 1 (stability and mobility training) includes some static-balance training (segmental and static whole-body stabilization), it is during the next level of training (phase 2: movement training) that the entire kinetic chain is integrated into more dynamic movement. During this phase, the dynamic nature of the movement patterns, especially when adding external resistance, will demand a greater need for bracing.

As noted earlier in the chapter, human movement can essentially be broken down into five primary movements that encompass all ADL (Figure 17-23). Movements can be as simple as one primary movement or as complex as the integration of several of them into a single motion. The five primary movements are as follows:

- Bend-and-lift movements (e.g., squatting)
- Single-leg movements (e.g., single-leg stance and lunging)
- Pushing movements (primarily in the vertical/horizontal planes)
- Pulling movements (primarily in the vertical/horizontal planes)
- Rotational (spiral) movements

a. Bend-and-lift movement

b. Single-leg movement

c. Pushing movement

d. Pulling movement

e. Rotational movement

Figure 17-23
Five primary movement patterns

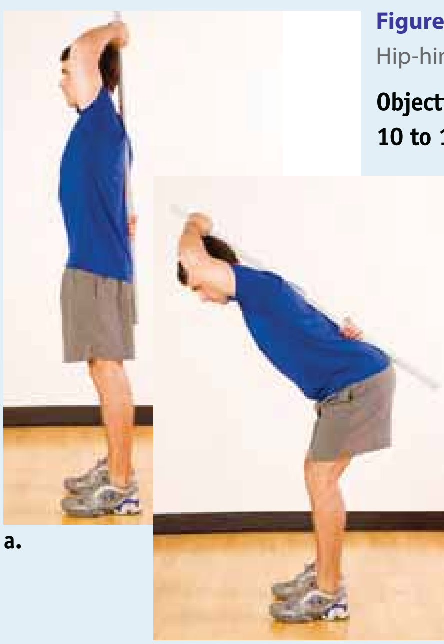
What is universal to all clients is the need to train these movement patterns as a prerequisite to all resistance-training exercises that involve an external load. In essence, if a client can perform these five primary movements effectively and possesses the appropriate levels of stability and mobility throughout the kinetic chain, it improves his or her potential for efficient movement and decreases the likelihood for compensation, pain, or injury (Gray & Tiberio, 2007). This phase of training follows stability and mobility training and involves teaching patterns for these five movements, using body weight as resistance and the **levers** within the body (e.g., the arms) as drivers to increase exercise intensity (Gray & Tiberio, 2007).

Bend-and-lift Movements

The bend-and-lift movement associated with the squat is perhaps one of the most prevalent activities used in strength training and throughout most individuals' ADL (e.g., sitting and standing), yet this movement is subject to much controversy given its potential for harm to the knees and low back, especially when an external load is added. Faulty movement patterns associated with poor technique will disrupt muscle function and joint loading, compromising performance and ultimately leading to overload and potential injury (Kendall et al., 2005; Sahrmann, 2002). Proper technique is therefore the key differentiator. One limiting factor to good technique is a lack of ankle mobility, which, according to Kendall et al. (2005), is normally between 15 and 20 degrees of ankle dorsiflexion. To evaluate this limitation, the health coach can have the client place one foot on a low riser [<12 inches (30 cm)], positioning the tibia perpendicular to the floor. The client leans slowly forward, dorsiflexing the ankle until the heel lifts off the floor or the ankle falls into pronation. The health coach can then determine the degree of motion achieved. Mobility of less than 15 degrees merits a need to improve ankle mobility prior to teaching the full bend-and-lift movement.

The bend-and-lift maneuver begins with a solid platform of good posture and bracing of the abdominal region (when using external loads). As the exercises in this training phase (phase 2: movement training) utilize body weight as the primary form of resistance, bracing might not be necessary, but clients should be reminded to brace the core when lifting external loads. Figures 17-24 through 17-26 provide examples of exercises that train the bend-and-lift movement pattern.

Throughout their daily activities, people often find themselves bending down to lift objects off the floor, and rarely do they use proper deadlift technique. Split- or staggered-stance positions, internal or external foot rotation, and even variations in arm position are common. Considering that these variations represent most individuals' daily movements, clients should be trained functionally to mimic these patterns. Therefore, once a client demonstrates proficiency with the bend-and-lift movement, progress the movement patterns to incorporating variations in foot position coupled with various arm movements (Figure 17-27). From a standpoint of functionality, people normally bend down to lift objects with their hands



a. b.

Figure 17-24
Hip-hinge

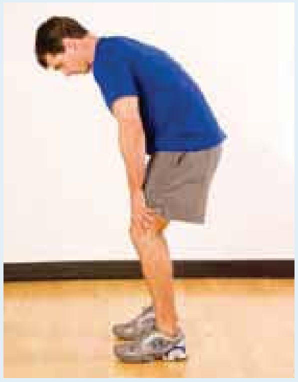
Objective: To emphasize "glute dominance" over "quad dominance" during the initial 10 to 15 degrees of movement

Preparation and position:

- Stand in a neutral stance position with the feet hip-width apart and place a light bar or dowel along the back that makes contact with the head, thoracic spine, and sacrum (three-point contact).
- Hold the bar above the head in one hand and around the low-back region with the other hand.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise (a).

Exercise:

- While pressing the dowel into the three points, slowly perform a forward bend, pushing the hips backward with slight knee flexion, while maintaining contact with the dowel on all three points at all times (b).
- The goal is to emphasize moving backward while minimizing the downward movement of the hips toward the floor.
- Perform one to three sets of 15 repetitions.


a.


b.

Figure 17-25
Pelvic tilts and back alignment

Objective: To promote pelvic control and lumbar stability throughout the lowering phase

Preparation and position:

- Stand in a neutral position with the feet hip-width apart, and, with the hands on the upper thighs, hip-hinge 10 to 15 degrees.
- Engage the core muscles to stabilize the lumbar spine in the neutral position.

Exercise:

- While holding this position, perform a series of pelvic tilts, changing the low-back position between flexion (rounding) and extension (arching).
- Perform one or two sets of five to 10 repetitions, holding each end position for one to two seconds.
- Move the hands down to rest on the knees, dropping deeper into the bend, and perform the same number of repetitions (a & b).
- Lower the body further, resting the elbows on the lower thighs and perform the same number of repetitions.
- Lower the hands toward the floor or to a low riser [<12 inches (30 cm)] and perform the same number of repetitions.
- Lower the hands to the floor to touch the underside of the front of the feet or shoes. (*Note:* Some heavier clients may not be physically able to achieve this position.) Once this position is achieved, perform full repetitions pushing through the heels to a full standing position, then return to this lowered position. Perform the same number of repetitions.


a.


b.

Figure 17-26
Lower-extremity alignment

Note: Based on the body-weight squat assessment (see page 348), health coaches can determine the need to strengthen the hip abductors or adductors.

Objective: To promote alignment among the hips, knees, and feet during a bend-and-lift movement

Preparation and position:

- Start seated in a chair, aligning the anterior superior iliac spine (ASIS) with the knee and second toe.
- Clients who need to strengthen the hip adductors can place a soft squeezable ball between the knees (a).
- Clients who need to strengthen the hip abductors can wrap an elastic band around the knees (b).
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.

Exercise:

- Perform one or two sets of five to 10 contractions, holding each contraction in the specific direction for one or two seconds.

Progression: Hold the isometric contraction while standing up out of the chair to full-standing position and returning into the chair. Perform one or two sets of 10 repetitions, holding the contraction in the specific direction throughout the movement.

Figure 17-27

Squat variations

a.

b.

c.

Note: Health coaches should progress to these exercises only when a client demonstrates good technique with a standard squat.

Objective: To promote stability and mobility throughout the kinetic chain with variations of the standard squat movement

Preparation and position:

- Start in the standing (neutral) position with the feet hip-width apart, but vary the position of the feet as follows:
  - ✓ *Staggered stance:* Right or left foot forward (a)
  - ✓ *Internal rotation:* Right or left foot rotated inward from neutral (always maintain knee alignment over the second toe) (b)
  - ✓ *External rotation:* Right or left foot rotated outward from neutral (always maintain knee alignment over the second toe) (c)
- Engage the core muscles to stabilize the lumbar spine in the neutral position. Maintain this position throughout the exercise.

Exercise:

- Hip-hinge and drop into a squat, ideally lowering the body to an end-range where the thighs are parallel with the floor or where the fingertips touch the floor.
- Perform one to three sets of 10 to 15 repetitions at a controlled tempo, varying foot positions.

Progressions: Adding the arms as drivers (bilaterally or unilaterally) increases the exercise intensity and the need for additional stability and mobility along the kinetic chain. For example, begin by driving the arms toward the floor during the lowering phase prior to driving the arms in all three planes with a high-arm position.

- Add the following drivers:
  - ✓ *Sagittal plane:* Drive both arms toward the floor or toward the ceiling during the lowering phase (d).
  - ✓ *Frontal plane:* Drive both arms to either side (lateral lean) during the lowering phase (e).
  - ✓ *Transverse plane:* Drive both arms in rotation to either side during the lowering phase (f).

d.

e.

f.

by their sides, so health coaches should teach these variations beginning with the most simplistic position (i.e., arms at the sides) prior to moving into high-arm positions (e.g., front squat, back squat, or overhead positions). Keep in mind that these high-arm positions require a greater degree of thoracic mobility, which many clients may lack. Thus, clients should be taught the bend and lift in the deadlift position first (i.e., arms at sides), before being introduced to the front-squat position and then the back and overhead positions.

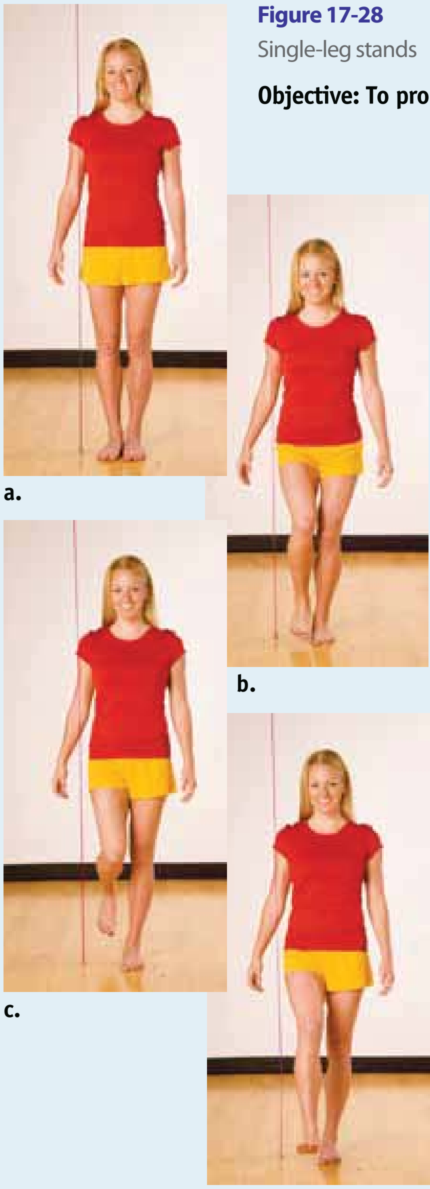
Single-leg Movement Patterns

Walking, the default movement pattern of human locomotion, puts the body into a single-leg stance position during each step as the raised leg swings forward (swing phase) just prior to the heel striking the ground. Standing efficiently on a single leg mandates stability in the stance leg, hip, and torso, while simultaneously exhibiting mobility in the raised leg if stepping is involved. Weakness in the hip abductors reflects an inability to control **lateral** hip shift, placing additional stress on the knee. Some clients will demonstrate this compensation during the balance assessments (i.e., sharpened Romberg test or stork-stand test—see pages 342–343) as their stance-leg hip hikes upward and the opposite hip drops downward. Sometimes clients with a lateral hip-shift weakness will only demonstrate their compensations during movement on a single leg. To check this, the health coach can have clients stand on one leg and slowly swing the free leg forward and backward in the sagittal plane. Lateral hip-shift weakness is present if, during the leg swing movement, the stance-leg hip shifts laterally more than a few millimeters. Clients who have this movement compensation should first strengthen the hip abductors in isolation (e.g., side-lying leg raise) before integrating full-body, weightbearing movements. Before learning any single-leg exercises (e.g., lunges), clients should learn how to effectively control hip adduction to prevent excessive lateral shift of the hip. Ultimately, individuals should demonstrate control of this lateral shift during gait, where the feet are positioned approximately 3.0 to 3.5 inches (7.6 to 8.9 cm) apart. However, clients should first be taught to do so from a feet-together position before progressing to the normal gait-width distance (Figure 17-28).

Static Balance on a Single Leg

Once an individual demonstrates the ability to effectively stand on one leg, the health coach can introduce dynamic movements of the upper and lower extremity over a static base of support. Next, various forms of resistance (e.g., medicine balls, cables, or bands) that increase the stabilization demands and the potential need for bracing during movement can be introduced. This is where the health coach's creativity in programming becomes important—to heighten the fun factor. Programming can be creative, but should always be progressed with common sense to keep the drills and exercises skill- and conditioning-level appropriate. The basic, but very functional, series of movement patterns presented in Table 17-11 and Figure 17-29 is based off the Balance Matrix created by Gary Gray, and incorporates both isolated and integrated upper- and lower-extremity movement in all three planes, all over a static base of support (Gray, 2008).

Progression for the single-leg stance involves adding external resistance and increasing the balance challenge. Holding a medicine ball or dumbbell, or introducing partial single-leg squats, adds resistance to the kinetic chain and increases the balance challenge. As resistance



a. b. c. d.

Figure 17-28

Single-leg stands

Objective: To promote stability within the stance-leg and hip during a single-leg stand

Preparation and position:

- The health coach hangs a plumb line from the ceiling or high fixed point, attaching a small weighted object (e.g., washer or nut) to the other end and suspending it 1 to 2 inches (2.5 to 5.1 cm) from the floor.
- Stand facing a mirror with feet together, positioning the right hip immediately adjacent to the plumb line (the plumb line should lightly touch the right hip).
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise (a).

Exercise:

- Hip-hinge 10 to 15 degrees, transferring the body weight into the heels.
- Contract the adductor and abductor muscle groups in the left thigh, then slowly raise the right heel 1 inch (2.5 cm) off the floor (do not raise the entire foot yet) (b).
- Briefly hold this position, then slowly unload the entire foot, lifting it 1 to 3 inches (2.5 to 7.6 cm) off the floor while watching the hip position in the mirror. Attempt to control the lateral hip shift away from the plumb line (to the exerciser's left). The goal is to prevent the space that appears between the line and hips from exceeding 2 inches (5.1 cm) [smaller individuals should aim for approximately 1 inch (2.5 cm) of space, while taller individuals should aim for 2 inches (5.1 cm)].
- Briefly hold this position, then slowly extend the hips and stand vertically, again controlling the spacing. The torso should not move and the stance-leg should remain stable.
- Perform one or two sets of five to 10 repetitions per leg, resting for 30 seconds between sets. Repeat with the opposite leg.

Progression: Perform a leg swing to mimic gait (i.e., from the hip-hinge position, swing the leg with each standing vertical stand) (c & d).

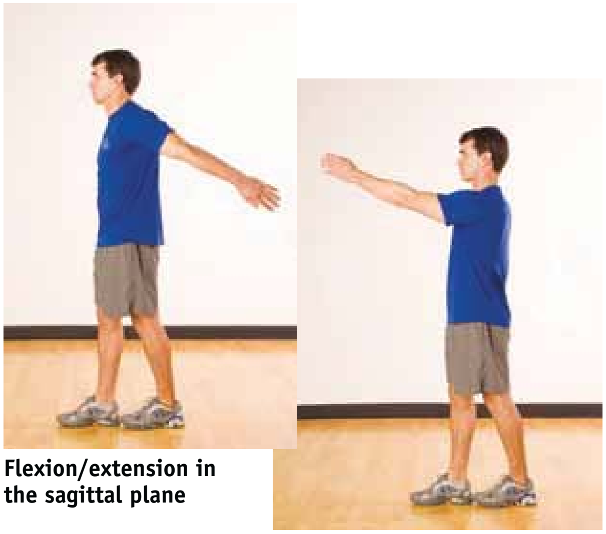
Progression: Repeat the same exercise with the feet positioned at the normal gait-width distance.

Note: This exercise can be performed without a plumb line if one is not available.

Table 17-11	
Dynamic Movement Patterns Over a Static Base of Support	
Introduce upper-extremity movements • Movements: ✓ Arms can move unilaterally (one arm at a time) ✓ Arms can move bilaterally (both arms move together) ✓ Arms can move reciprocally (alternating arm directions) ✓ Position the feet in any stance indicated in Figure 17-22 (except single-leg stance) • Directions: ✓ Move arm(s) in the sagittal plane (flexion/extension) ✓ Move arm(s) in the frontal plane (lateral flexion from an overhead position) ✓ Move arm(s) in the transverse plane (rotation from the shoulder-height position with a bent elbow)	Perform the following: • 1–2 sets of 10–20 repetitions per side • Slow, controlled tempos [avoid bouncing at the end-ROM—the transition zone between movement in one direction and movement in another direction (also known as the transformational zone)] • Less than 30-second rest intervals between sets
Introduce lower-extremity movements • Movements: ✓ Assume a single-leg stand ✓ Start by swinging the leg forward and backward, touching the toes to the floor at each end-ROM (transformational zone), then progress to unsupported leg swings. • Directions: ✓ Move the leg in the sagittal plane (flexion/extension) ✓ Move the leg in the frontal plane (abduction/adduction) ✓ Move the leg in the transverse plane (rotation in front or behind the stance leg)	Perform the following: • 1–2 sets of 10–20 repetitions per side • Slow, controlled tempos (avoid bouncing at the end-ROM—the transformational zone) • Less than 30-second rest intervals between sets
Integrate upper- and lower-extremity movements • Move limbs ipsilaterally (same side) or contralaterally (opposite side) • Move limbs "in synch"—moving in the same direction (e.g., the leg and arm move forward together) • Move limbs "out of synch"—moving in opposite directions	Perform the following: • 1–2 sets of 10–20 repetitions per side • Slow, controlled tempos (avoid bouncing at the end-ROM—the transformational zone) • Less than 30-second rest intervals between sets

Note: ROM = Range of motion

Figure 17-29
Dynamic movement patterns



Flexion/extension in the sagittal plane

Rotation in the transverse plane

Adduction/abduction in the frontal plane

Rotation in the transverse plane

Contralateral flexion/extension in sagittal plane

Contralateral rotation in transverse plane

(load) increases, the number of repetitions per set, and possibly total number of sets, should be reduced with longer rest intervals between sets (e.g., 30 to 60 seconds).

A primary single-leg pattern involves teaching clients how to lunge effectively, a movement pattern that is often performed poorly in any plane. While lunge mechanics are very similar to the squat or bend-and-lift mechanics, many individuals deviate from basic movement principles (Cook & Jones, 2007b). The exercises presented in Figure 17-30 teach the mechanics of the lunge and variations to the basic lunge.

As with squats, people often find themselves performing variations to the traditional lunge during their daily activities, workouts (e.g., side lunges), or even during sports (e.g., cutting and sidestepping). These variations involve directional lunges, foot-position variations, and movements with the upper extremities in all three planes of movement. Considering these

a.

b.

c.

Figure 17-30
Lunges

Objective: To teach the proper mechanics of the full lunge

Preparation and position:

- Start in the standing position, with the feet hip-width apart, shoulders packed (see Figure 17-16), head neutral, and weight distributed toward the heels.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.

Exercise:

- Slowly lift one leg, controlling the lateral hip shift and reaching forward to take a small step [<24 inches (61 cm)], lightly touching the heel on the floor. Briefly hold this position (a).
- Allow the entire foot to make contact. Once it is firmly positioned on the ground, initiate a hip-hinge movement to begin the downward phase of the lunge (b). This allows for a more natural hinge motion at the knee and reduces the shearing forces.
- Lower the hips and shoulders together, allowing a slight forward torso lean, but maintain strong core engagement to avoid lumbar lordosis (c).
- Avoid any misalignment of the knee over the foot, as well as hip adduction and torso rotation.
- In the lowered position, the health coach can check for the following:
  - ✓ Alignment in the frontal plane of the anterior superior iliac spine (ASIS), knee, and second toe
  - ✓ The figure-4 position with the leading leg and torso in parallel, with the leading leg near perpendicular to the floor (exhibiting a slight forward lean—tibial translation)
  - ✓ No lateral weight shifting or torso rotation
- Perform one to three sets of 12 to 15 repetitions with a controlled tempo, allowing 30-second rest intervals between sets.
- Use the glute "push" and hamstrings "pull" to rise out of the lunge.

variations represent daily movements, clients should be trained functionally to mimic these patterns. Once a client demonstrates proficiency with the standard lunge pattern, the health coach can progress the exercise to include directional changes, different foot positions, and upper-extremity movement (Figure 17-31). Bear in mind that high-arm positions require a greater degree of thoracic and hip mobility, which a client may lack. Therefore, clients should begin by driving the arms in the low position prior to incorporating the high-arm-position movements.


a.


b.

Figure 17-31
Lunge matrix

Note: Health coaches should progress to this exercise only after a client demonstrates good technique with a standard forward lunge.

Objective: To promote stability and mobility throughout the kinetic chain using variations of the standard lunge movement

Preparation and position:

- Using the grid presented in the illustration (next page), the health coach can teach the client to move in all eight directions, starting and ending each repetition from the center position.
- Engage the core muscles to stabilize the lumbar spine in the neutral position and maintain this position throughout the exercise.

Exercise:

- The health coach teaches the directional movements with stepping prior to introducing lunges.
- When lunging forward, backward, and sideways, align the feet and hips forward (a, c, e, & g).
- When lunging to the oblique angles, align the feet and hips in that direction (b, d, f, & h).
- Follow the same technique instructions outlined in Figure 17-30.
- Perform one to three sets to each direction with each leg.

Source: Gray, G. & Tiberio, D. (2007). *Chain Reaction Function.* Adrian, Mich.: Gray Institute.


c.

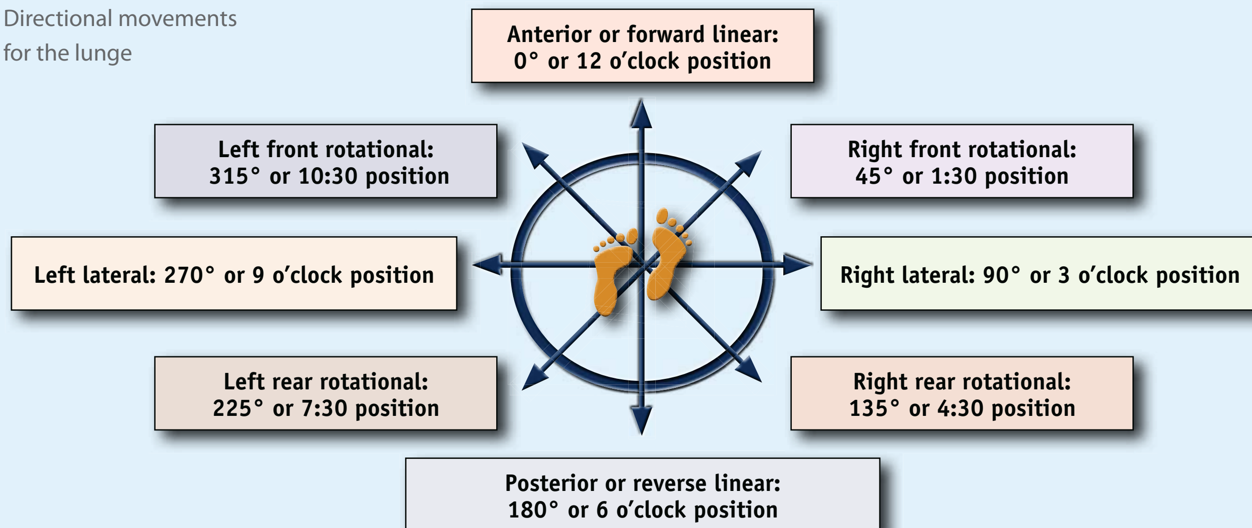

d.


e.

Continued on next page

f. g. h.

Directional movements for the lunge



When working with more athletic individuals, these same movement patterns can progress to jumps, hops, or bounds. However, individuals should never begin jumping, bounding, or hopping activities until they can effectively demonstrate correct landing technique and the ability to decelerate the impact forces of landing.

Pushing Movements

In everyday activities, pushing movements are pervasive, as they move the arms in front of the body or over the head. If the shoulder joint and shoulder girdle muscles work together properly, pushing actions can be performed effectively with minimal stress to the upper-extremity joints. When altered joint mechanics are present, such as the case when muscles have become adaptively shortened or lengthened due to repetitive use or poor posture, the risk for injury increases.

During shoulder flexion (e.g., front raise exercise or pushing open a door) and overhead presses (e.g., dumbbell press exercise or putting luggage into an overhead compartment

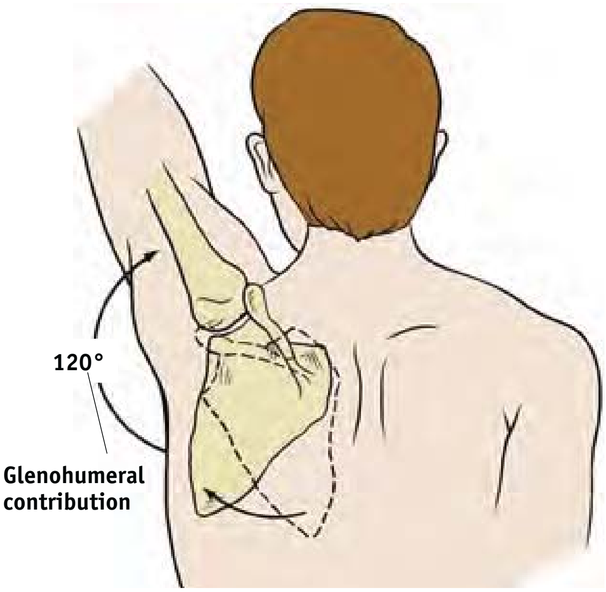


Figure 17-32
The movement of the arm is accompanied by movement of the scapula—a ratio of approximately 2° of arm movement for every 1° of scapular movement occurs during shoulder abduction and flexion; this relationship is known as scapulohumeral rhythm.

on an airplane), movement to 180 degrees is achieved by the collaborative effort of the scapulae rotating against the ribcage and the humerus rotating within the glenoid fossa. The movement generally requires approximately 60 degrees of scapular rotation and 120 degrees of glenohumeral rotation (Figure 17-32) (Sahrmann, 2002). While the scapulae require some degree of mobility to perform the various movements of the arm, they fundamentally need to remain stable to promote normal mobility within the glenohumeral joint. During these movements, insufficient, premature, or excessive activation of specific scapular muscles (e.g., dominant rhomboids resisting upward scapular rotation or overactive upper trapezius forcing excessive scapular elevation) will compromise scapular stability, which in turn affects the ability of the muscles around the glenohumeral joint to execute their function effectively. For example, if the scapulae cannot sink slightly while the arms extend overhead, this may interfere with scapular rotation and scapular stability. This forces the glenohumeral joint to assume greater loads, reducing its force-generating capacity and increasing the potential for injury (Cook & Jones, 2007a). This illustrates the importance of setting or packing the scapulae prior to shoulder flexion or abduction movements.

Exercises during this phase of training progress beyond stability and shift toward integrating whole-body movement patterns. Exercises can begin with more traditional pushing and pulling movements that primarily target the shoulder girdle in a bilateral or unilateral fashion, using supported backrests, then progress to becoming unsupported (e.g., standing in a normal or split-stance position), which better mimics most ADL (Figure 17-33).

Another common mistake made when performing overhead presses is the tendency to simply yield to gravity during the **eccentric** or downward phase of a shoulder press. This creates instability within the shoulder joint, given the changing roles of the deltoids between the starting and overhead position (Cook & Jones, 2007a). This overhead shoulder press position may increase the potential for anterior displacement of the humerus, given the lack of support from the anterior deltoid in the overhead position. However, the latissimus dorsi wraps around the anterior capsule from behind and, when elongated or loaded, can offer stability to the anterior shoulder (Cook & Jones, 2007a). Therefore, if the latissimus dorsi is engaged to begin the lowering phase, anterior containment is provided to help stabilize the shoulder and precipitate greater force production during the lifting phase. Thus, clients should be coached to engage the latissimus dorsi during the lowering phase and not simply yield to gravity (Figure 17-34).

Pulling Movements

The common actions of pulling open a door or lifting objects to hold them close to the body are examples of how people use pulling movements in their everyday activities. Similar to the body mechanics of pushing, when the shoulder and shoulder girdle are functioning within their ideal ranges of motion, pulling movements are effective actions that transfer minimal stress to the joints. However, muscles that do not provide the


a.

Figure 17-33
Bilateral and unilateral presses

Objective: To execute open-chain pushing movements in unsupported environments without compromising stability in the scapulothoracic joint and lumbar spine

Preparation and position:

- Assume a seated position on a seat or bench of any weightstack or cable-press machine, making contact with the backrest. Progress by repeating the movement without any contact against the backrest.
- Grasp the machine or cable handles firmly in both hands, positioning the hands close to the chest in a starting press position.
- Pack both shoulders (see Figure 17-16) and brace the core, holding these positions throughout the exercise.


b.

Exercise:

- Exhale and gently press the load away bilaterally from the chest, preventing any change to the position of the lumbar spine or scapulae (do not perform a push-plus by protracting the scapulae when the elbows fully extend or elevate the scapulae). The goal is to reach full elbow extension, yet maintain a stable trunk and shoulder girdle (a).
- Slowly return to the starting position by adducting the scapulae (maintain the same starting position).
- Perform one or two sets of 12 to 15 repetitions with a controlled tempo, allowing 30-second rest intervals between sets.


c.

Progression—Standing press: Repeat the same bilateral movement, but from a standing, split-stance position, alternating the forward leg with each set (b). A cable press or TRX® are suitable pieces of equipment to introduce for these progressions.

Progression—Single-arm press with a contralateral stance: Repeat the same movement, but pushing unilaterally with one arm, while the opposite leg is positioned forward in the split-stance position (c).

Progression—Single-arm press with an ipsilateral stance: Repeat the same movement, but pushing unilaterally with one arm, while the same-side leg is positioned forward in the split-stance position (d). The challenge is to resist the body's tendency to rotate during the push movement.


d.

a.

b.

Figure 17-34

Overhead press

Objective: To provide additional stability to the shoulder capsule during the lowering phase of overhead pressing movements

Preparation and position:

- Using a dowel or lightly weighted bar, assume a seated position to perform a seated overhead press.
- Pack both shoulders (see Figure 17-16) and brace the core, holding these positions throughout the exercise.
- Press the bar overhead to the fully extended arm position, ensuring that the scapulae are not elevated (a).

Exercise:

- Actively engage the latissimus dorsi to initiate the pull-down sequence, lowering the bar to the starting position.
- Perform one or two sets of 12 to 15 repetitions with a controlled tempo, allowing 30-second rest intervals between sets.

Progression: Holding dumbbells, perform a variety of shoulder-press movements while introducing changes in the plane of movement:

- Add a trunk rotation, pressing upward across and even behind the body (b).
- Add lateral trunk movements (e.g., side lunge) and press overhead or across the front of the body.
- Assume a squat position, holding the dumbbells closer to waist level, and perform a series of uppercuts, driving the dumbbells across and behind the body to an end-point just above shoulder level.

appropriate strength or stability in the upper extremity—especially those that have attachments on the scapulae, ribcage, and humerus—can end up adding excess wear on the joints as they cannot effectively transfer mechanical forces.

Pulling movements follow many of the same principles as pressing movements with regard to stabilizing the scapulothoracic region, which helps promote effective glenohumeral function (Figure 17-35). Health coaches should identify whether they want to train a client to pull from a position of scapular stability, implying that the movement is purely from the shoulder (i.e., glenohumeral or shoulder extension/horizontal extension), or whether they are intentionally incorporating scapular retraction and adduction into the pulling motion. Clients whose scapular stability is compromised, such as those who exhibit forward-rounded shoulders, abducted scapulae, or winging of the scapulae, should perform pulling exercises—at least initially—from a position of scapular stability with very little resistance (external load). This means that the scapulae are in the set position and they do not move as the glenohumeral joint acts in extension or horizontal extension. Once the client has demonstrated that he or she is able to maintain the scapular set position for various pulling movements, scapular retraction and adduction can be added to the pulling exercises to ensure that the scapulothoracic and glenohumeral joints have the opportunity to move as they should during normal daily activities.

Exercises to promote effective pulling can begin with more traditional movements that primarily target the shoulder girdle in a bilateral or unilateral fashion, using supported backrests, then progress to becoming unsupported (e.g., standing in a normal, split-stance, or lunge position) that mimic most ADL.

a.

b.

c.

Figure 17-35

Bilateral and unilateral rows

Objective: To execute open-kinetic-chain pulling movements in unsupported environments without compromising stability of the scapulothoracic joint and lumbar spine

Preparation and position:

- Assume a seated position on a seat or bench of any weightstack or cable machine, making contact with a chest plate or rest. Progress by repeating the movement without any contact against a rest.
- Pack both shoulders (see Figure 17-16) and brace the core, holding these positions throughout the exercise.
- Grasp the machine or cable handles firmly in both hands, in a shoulder-flexed, elbow-extended position without protracting the scapulae.

Exercise:

- Exhale and gently pull the load bilaterally toward the body, preventing any change to the position of the lumbar spine or scapulae (avoid retracting or squeezing the shoulder blades together). The goal is to continue pulling until the elbows are bent 90 degrees, yet maintain a stable trunk and shoulder girdle.
- Slowly return to the starting position by extending the arms.
- Perform one or two sets of 12 to 15 repetitions with a controlled tempo, allowing 30-second rest intervals between sets.

Progression—Standing pull: Repeat the same bilateral movement, but from a standing, split-stance position, alternating the forward leg with each set (a). A cable pull or TRX are suitable pieces of equipment to introduce for these progressions.

Progression—Single-arm pull with a contralateral stand: Repeat the same movement, but pulling unilaterally with one arm while the opposite leg is positioned forward in the split-stance position (b).

Progression—Single-arm pull with an ipsilateral stand: Repeat the same movement, but pulling unilaterally with one arm, while the same-side leg is positioned forward in the split-stance position (c). The challenge is to resist the body's temptation to rotate during the pulling movement.

Rotational Movements

Rotational movements represent the last of the primary movements and are perhaps some of the most complex movements, given how many follow spiral or diagonal patterns throughout the body. These movements generally incorporate movement into multiple planes simultaneously (e.g., a golf backswing requires transverse plane rotation, thoracic and lumbar extension, and some lateral flexion). Many of these movements increase the forces placed along the vertebrae, so health coaches must exercise care when teaching these movements and only do so after the client has conditioned the core effectively.

Consideration of good technique and appropriate levels of mobility and stability in the thoracic and lumbar spine is critical in facilitating synchronous movement and dissipating the generated ground reactive forces over larger surface areas (e.g., upward toward the cervical vertebra and downward toward the hips, knees, and ankles) (Gray & Tiberio, 2007). The ability to dissipate ground reactive forces reduces the impact on local areas and decreases the potential for injury.

Two key movements involving diagonal or spiral patterns of movement within the arms, shoulders, trunks, hips, and legs are the wood chop and the hay bailer:

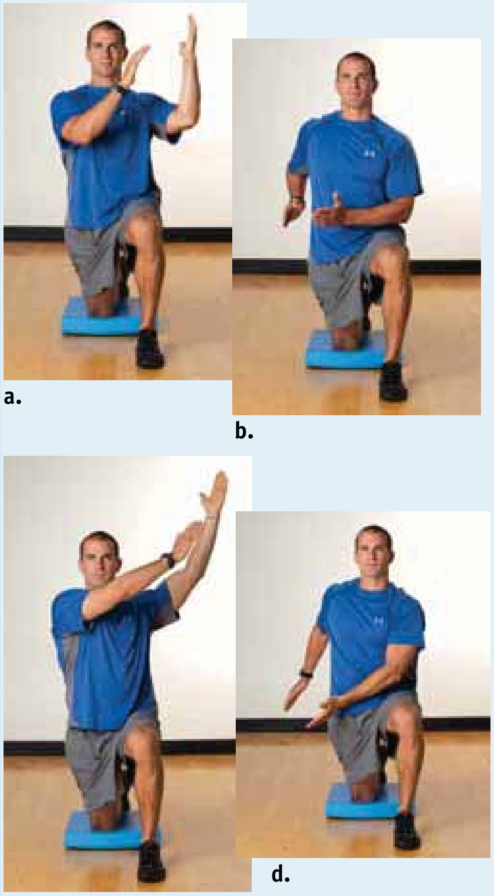
- *Wood chops*: This exercise involves a pulling action to initiate the movement down across the front of the body, followed by a pushing action in the upper extremity as the arms move away from the body (Figure 17-36). In addition, it requires stabilization of the trunk in all three planes (i.e., during flexion, rotation, and side-bending), and weight transference through the hips and between the legs to gain leverage and maintain balance (Cook & Jones, 2007b). **Concentric** action during the downward chop is achieved by using a high anchor point (e.g., high cable pulley or band).
- *Hay bailers*: This exercise involves a pulling action to initiate the movement up across the front of the body, followed by a pushing action in the upper extremity as the arms move away from the body (Figure 17-37). In addition, it requires stabilization of the trunk in all three planes (extension in the sagittal plane, rotation in the transverse plane, and side-bending in the frontal plane), and weight transference through the hips and between the legs to gain leverage and maintain balance (Cook & Jones, 2007b).

The need for thoracic mobility is greater during these movements than with the pushes and pulls, given the three-dimensional nature of the movement patterns. Performing these exercises without thoracic mobility or lumbar stability may compromise the shoulders and hips, and increase the likelihood for injury. The thoracic spine offers greater mobility than the lumbar spine. Therefore, lumbar stability and control of lumbar rotation should be emphasized while promoting movement within the thoracic spine.

Program Design for Beginners

The basic programming guidelines in the movement-training phase are to give clients exercises to help them develop proper control and adequate ROM while performing the five basic movements. The timeframe for movement training is two weeks to two months, depending on each client's initial level of movement ability and his or her rate of progression. The FIRST acronym can be used to guide exercise program design: frequency, intensity, repetitions, sets, and type.

- *Frequency*: Two to three days per week is adequate for the beginning stages of a movement-training program. Considering that many clients who are deconditioned



a. b. c. d.

Figure 17-36

Wood-chop spiral patterns

Note: Given the complexity of the wood-chop movement, the individual should first learn basic spiral patterns without placing excessive loads upon the spine.

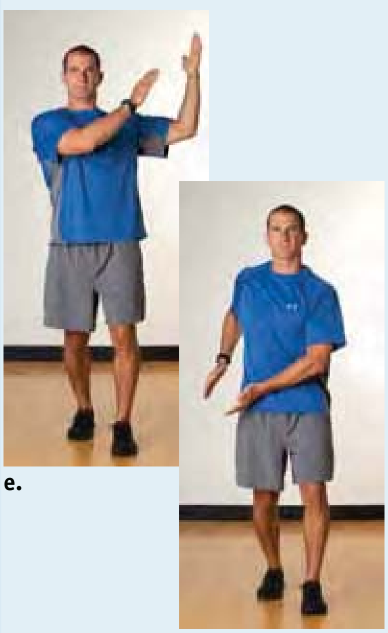
Objective: To introduce basic spiral patterns with small, controlled forces placed along the spine

Preparation and position:

- Assume a half-kneeling position, placing the rear knee directly under the hips. This position engages both the hip flexors and extensors to help stabilize the spine.
- An unstable surface may be placed under the rear knee to increase the stability demands on the core. *Note:* Clients should only progress to the unstable surface after demonstrating good core strength and stability.
- Pack both shoulders (see Figure 17-16) and brace the core, holding these positions throughout the exercise.
- Imagine holding a short handle that positions the hands 6 to 12 inches (15 to 30 cm) apart and raise the handle toward the shoulder on the same side as the leading leg, keeping both hands close to the body (a).
- The hips and torso (chest) should remain aligned forward.

Exercise:

- Exhale and slowly perform a downward movement across the front of the body, moving the handle toward the opposite hip and keeping both arms close to the body to shorten the length of the lever (called the moment arm) (b).
- The hips and torso (chest) should remain aligned forward.
- Return to the starting position and repeat.
- Perform one or two sets of 12 to 15 repetitions in each direction, alternating the knee position with each directional change.



e. f.

g.

Progression—Long moment arm: Repeat the same movement, but extend the arms (acting as a driver) to increase the range of motion and leverage, but keep both arms close the body during the movement (c & d). The hips and torso (chest) should remain aligned forward.

h.

Progression—Standing short moment arm: Assume a split-stance position, placing the leg on the same side as the chop start position forward. Bend both elbows, placing the hands 6 to 12 inches (15 to 30 cm) apart and raise the handle toward the shoulder on the same side as the leading leg, keeping both hands close to the body (e & f). Repeat the same chopping movement with bent elbows. The hips and torso (chest) should remain aligned forward.

Progression—Standing long moment arm: Assume the same split-stance position and repeat the same chopping movement, but extend the arms (g & h). The hips and torso (chest) should remain aligned forward.

a.

b.

c.

d.

e.

f.

Figure 17-37

Full wood-chop and hay-bailer patterns

Objective: To introduce the full multiplanar wood-chop and hay-bailer movement patterns while controlling forces placed along the spine

Preparation and position (a & b):

- Assume a staggered position, placing the inside leg 6 to 12 inches (15 to 30 cm) forward.
- Pack both shoulders (see Figure 17-16) and brace the core, holding these positions throughout the exercise.
- Imagine holding a short handle that positions the hands 6 to 12 inches (15 to 30 cm) apart and raise the handle toward the inside shoulder on the same side as the leading leg, keeping both hands close to the body.
- Load 60 to 70% of the body weight onto the inside leg.

Exercise:

- Exhale, hip-hinge (hip flex), and squat while rotating the hips outward, transferring 60 to 70% of the body weight onto the outside leg.
- While the hips rotate, the chest and shoulders should remain aligned over the pubis (center of the pelvis).
- Return to the starting position and repeat.
- Perform one or two sets of 12 to 15 repetitions in each direction, alternating the stance position with each directional change.

Progression—Long moment arm: Repeat the same movement, but extend the elbows and move the hands 2 to 3 feet (0.6 to 0.9 m) apart (the use of a dowel might prove useful). A wide, extended grip concentrates force-generation from the hips and not from the shoulder or arms. Repeat the movement and, while the hips rotate, the chest and shoulders should remain aligned over the pubis (center of the pelvis).

Progression—Full chop (c & d): Repeat the same movement, but allow the torso to rotate further into the start position and rotate past the hips at the end position. Allow the unloaded leg to pivot during the movement to help transfer and dissipate forces.

Progression (e & f): Add external resistance in the form of a medicine ball, kettle bell, cable, or elastic tubing.

and have a weight-loss goal will also be engaging in regular cardiorespiratory training, a frequency of two days per week may be a more appropriate recommendation.

- *Intensity*: Since the goal is to focus on coordination and muscular conditioning for the basic movement patterns, clients should not use any external load while performing the exercises.
- *Repetitions*: An appropriate repetition range for movement training is 12 to 20 repetitions.
- *Sets*: A range of two to three sets is appropriate for each movement-training exercise.
- *Type*: Exercise selection should focus on the five basic movement patterns: squats, lunges, pushes (both in the horizontal plane and overhead), pulls, and rotational movements.

Adding Resistance to Movement Training

When the five primary movements can be performed with proper form, external resistance may be applied for progressive strength development. It is essential that the external loads are increased gradually so that correct movement patterns are not altered during the exercise performance. See the following section on program design for load training (phase 3) for specific guidelines for safely and effectively increasing weight loads.

- *Squat:* External loading may be applied with various types of resistance equipment. A client may begin by holding a medicine ball while doing squats. Another resistance option is placing an elastic band under the feet and holding each end of the band while performing squats. A third resistance tool is free weights, beginning with dumbbells and progressing to barbell squats when the legs can handle more resistance than the hands can hold. An alternative exercise to the barbell squat is the leg press, which trains the same pattern of movement without the direct pull of gravity, while strengthening the quadriceps, hamstrings, and gluteus maximus muscles.
- *Lunge:* Lunge movements (in any direction) may be performed with external loads by holding a medicine ball or dumbbells. Initially, resistance bands and barbells are not recommended tools for lunge movements, as lunging is a high balance-challenge activity and the unpredictable forces of elastic resistance and the awkward length of barbells might make it too difficult for clients who have minimal experience with lower-extremity exercise.
- *Pushing movements:* Pushing movements may be performed with added resistance by using resistance bands or cables in a standing position, by performing machine chest presses from a seated position, or by lifting free weights (dumbbells or barbells) from a lying (supine) position. Medicine balls may also be used for pushing movements from a supine position, and from a standing position by performing a chest pass (releasing the medicine ball).
- *Pulling movements:* Pulling movements may be performed with external loads by using resistance bands or cables in a standing position, by performing machine rows and pull-downs from a seated position, and by lifting dumbbells from a bent-over standing position with the torso parallel to the floor and supported by one arm (bent-over row exercise). Medicine balls and barbells are not recommended for beginners for rowing exercises, because one arm is not free for torso support.
- *Rotational movements:* External resistance may be applied to rotational movements by using resistance bands or cables in a standing position, by using machines from a seated position, or by lifting medicine balls from a variety of positions (standing, seated, and lying). It can be difficult to use barbells in rotational movements, but dumbbells can be used in movements that directly oppose gravity's line of pull.

Program Design for Beginners

The acronym FIRST may be used to designate the five key components of resistance-training program design: frequency, intensity, repetitions, sets, and type of exercise. During the initial weeks of resistance training, motor learning plays a major role in the desired physical development and movement patterns. Consequently, during this training period, exercise repetition should be emphasized over exercise intensity.

- *Frequency:* Beginning exercisers experience excellent results by strength training two to three days a week, and this is the recommended training frequency during the movement-training phase.
- *Intensity:* Due to the emphasis on proper movement patterns, the training intensity is lower during this phase. Start with a light resistance that allows clients to learn proper movement techniques and then progress resistance to a maximum of 60 to 70% of maximum resistance.
- *Repetitions:* The number of repetitions performed varies inversely with the intensity of the exercise set. That is, fewer repetitions can be performed with a higher resistance and more repetitions can be completed with a lower resistance. During the movement-training phase, the lower training intensity permits more repetitions in each exercise set. Most people can perform about 12 repetitions with 70% of maximum resistance and about 16 repetitions with 60% of maximum resistance. It is therefore recommended that movement-training phase exercises first be performed with light resistance that allows for proper movement patterns to be learned, and then progressed to weightloads that allow the movement to be completed for between 12 and 16 repetitions. Generally, if the resistance does not permit at least 12 repetitions, it should be reduced. When 16 repetitions can be properly performed, the resistance should be increased by approximately 5%.
- *Sets:* Studies have demonstrated that one set of resistance exercise is as effective as multiple training sets (Carpinelli & Otto, 1998; Starkey et al., 1996), especially for beginning exercisers. For movement-training phase workouts, one set of each exercise is certainly a good starting point. As training progresses, more sets of each exercise may be performed as determined by the client's desire to do so. During the first 10 to 12 weeks of resistance exercise, both single- and multiple-set training have been shown to increase lean (muscle) weight by approximately 3 pounds (1.4 kg) (Westcott, 2009; Campbell et al., 1994). Single-set programs are an effective way to help previously sedentary clients become comfortable with the challenges of resistance training. When the client demonstrates consistent adherence and initial adaptations to a single-set program, the volume of sets can increase.
- *Type:* The type of exercise should be selected to help the client learn and improve movement patterns with respect to his or her muscular fitness and strength-training experience. Clients with less muscle strength and training experience should begin with basic exercises performed with external resistance and relatively stable conditions. Exercise selection can begin with machines, which utilize the basic movement patterns of exercise but provide stability and control the path of motion. Once a client demonstrates progress with motor control and muscular strength, he or she can begin performing ground-based standing exercises that emphasize muscle integration.

Such exercises include dumbbell squats, overhead dumbbell presses, standing cable rows, and standing cable presses. As strength increases, emphasis may be placed on multiplanar movements that require higher levels of muscle integration. Movements may be performed from unsupported postures, with closed-kinetic-chain exercises for the lower-body muscles and open-kinetic-chain exercises for the upper-body muscles. Free-moving lever-action exercises are appropriate during movement training.

Appropriate Rates of Progression for Beginners

The standard recommendation for progression is a 5% resistance increase whenever the end range number of repetitions can be completed. However, during the early stages of resistance training, the motor-learning effect enhances strength gains by facilitating muscle-fiber recruitment and contraction efficiency. Therefore, during the movement-training phase, resistance increases may be more than 5% if the exerciser experiences a relatively fast rate of progression. For example, when a client completes 16 repetitions with 100 pounds (45 kg), the weightload may be increased up to 110 pounds (50 kg) (10% increase), as long as at least 12 repetitions can be performed with the heavier resistance.

Once the exercises can be executed with correct movement patterns while maintaining neutral posture, a stable center of gravity, and controlled movement speed, clients may progress to the load-training phase (phase 3).

Phase 3: Load Training

In the load-training phase, the training emphasis progresses from stability and mobility and movement training to muscle force production, which can be addressed in different ways to attain specific developmental objectives. The training objectives may include increased muscular endurance, increased muscular strength, increased muscle **hypertrophy,** as well as improved body composition, movement, function, and health. Regardless of the specific objective of the load-training program, it is recommended that stability and mobility training and movement training exercises be included in the warm-up and cool-down activities.

EXPAND YOUR KNOWLEDGE

Resistance Training Is Not a Factor in Weight Loss

The reason that resistance training is not included as a major factor in the exercise recommendations for weight loss for overweight and obese individuals is because there is a lack of evidence to support weight training for weight loss and maintenance. While it is true that resistance training may increase muscle mass, which can create positive changes in body composition and may in turn increase daily energy expenditure, it does not seem to be effective for weight reduction in the initial months of training, nor does it add to weight loss when combined with diet restriction [American College of Sports Medicine (ACSM), 2009].

However, it is important that health coaches do not discount the role of resistance training in health improvement. In addition to the functional movement and performance benefits provided by regular resistance training, lifting weights has been associated with improvements in CVD risk factors, even in the absence of significant weight loss. Regular resistance training has been shown to increase **high-density lipoprotein (HDL) cholesterol** (Hurley et al., 1988), decrease **low-density lipoprotein (LDL)** (Hurley et al., 1988; Goldberg et al., 1984), and decrease triglycerides (Goldberg et al., 1984). Reductions in both **systolic** and **diastolic blood pressure** have also been reported as a result of participation in a resistance-training program (Kelley, 1997; Norris, Carroll, & Cochrane, 1990).

Perhaps the most revealing evidence to support to the health benefits of weight training is related to its association with improvements in type 2 diabetes. Improved **insulin** sensitivity has been reported in individuals who engage in resistance-training programs (Di Pietro et al., 2006; Ibanez et al., 2005). In addition, Church and colleagues (2010) found that performing a combination of aerobic exercise and resistance training was associated with improved glycemic levels among patients with type 2 diabetes, compared to patients who did not exercise. The level of improvement was not seen among patients who performed either aerobic exercise or resistance training alone. Taken together, these findings suggest that both aerobic endurance exercise and resistance training must be included in a well-rounded exercise program.

Program Design for Improving Muscular Strength

Muscular strength is a measure of the maximum force that can be produced by one or more muscle groups, and is typically assessed by the **one-repetition maximum (1-RM**) weightload in an exercise (e.g., leg press and bench press). If a client increases his or her 1-RM bench press from 200 pounds (91 kg) to 250 pounds (114 kg), he or she has experienced a 25% improvement in bench press strength. Although some of the weightload increase may be attributed to motor learning, much of the improvement would be due to strength development in the pushing muscles—pectoralis major, anterior deltoids, and triceps—as a result of a progressively challenging training program. Although increases in muscular strength are accompanied by increases in muscular endurance, preferred protocols for strength development place more emphasis on training intensity.

The FIRST recommendations for improving muscular strength are as follows:

- *Frequency:* High-intensity resistance training causes significant tissue microtrauma that typically requires 72 hours for muscle remodeling to higher strength levels (McLester et al., 2003). Consequently, clients who complete total-body workouts should schedule two training sessions per week. Clients who prefer to perform split routines (working different muscle groups or movement patterns on different days) should take at least 72 hours between workouts for the same muscles. For example, clients who do pushing movements for the chest, shoulders, and triceps on Mondays and Thursdays, pulling movements for the upper back and biceps on Tuesdays and Fridays, and squat, lunge, and rotational movements for the legs and trunk on Wednesdays and Saturdays have six weekly workouts, but provide at least 72 hours of recovery time between exercises for the same muscle groups.
- *Intensity:* The initial stages of muscular-strength training may be successfully conducted with a range of weightloads (e.g., 70 to 90% of maximum resistance). However, for optimal strength development, most authorities recommend weightloads between 80 and 90% of the 1 RM. Exercises with near-maximum weightloads that allow one to three repetitions with more than 90% of maximum resistance are highly effective for developing muscular strength. However, these exercises are not appropriate for the average client unless he or she has a training goal directly related to increased strength. Because these are relatively heavy weightloads, a periodized approach that progressively increases the training intensity over several weeks is recommended.

- *Repetitions:* Repetition ranges are essentially determined by the exercise resistance. Because exercises with relatively high exercise weightloads cannot be performed for many repetitions, training for muscular strength involves fewer repetitions than training for muscular endurance. Most individuals can complete about four repetitions with 90% of maximum resistance and about eight repetitions with 80% of maximum resistance. Therefore, the recommended repetition range for muscular strength development is four to eight repetitions. When nine repetitions can be completed with correct training technique, the weightload should be increased by approximately 5%.
- *Sets:* Muscular strength can be significantly increased through either single-set or multiple-set training (Carpinelli & Otto, 1998; Starkey et al., 1996). It may be prudent to start clients with one hard set of each exercise (after performing progressively challenging warm-up sets), and increase the number of stimulus sets in accordance with clients' interest and ability to performing additional sets. Generally, muscular-strength programs do not exceed three to four sets of each training exercise. To perform repeated exercise sets with relatively heavy weightloads, clients must take longer recovery periods between successive sets. Unlike muscular-endurance training, which features one- to two-minute rests between sets, muscular-strength training generally features three- to four-minute recovery periods between sets of the same exercise. The longer rests lead to longer workouts for muscular-strength training programs. For example, a standard 10-exercise workout could require about two hours (125 minutes) for completion (3 sets x 10 exercises x 40-second performance plus 30 x 210 seconds recovery time). Fortunately, single-set training programs can effectively increase muscular strength in much shorter exercise sessions. For example, a single set of 10 exercises would require about 20 to 25 minutes for completion, and the inclusion of a warm-up set for each exercise would make the workout about 45 to 50 minutes in duration on the high end. Single-set programs using an appropriate warm-up and a challenging training intensity are effective means of helping clients maintain adherence to their programs when they have other demands for their time, such as a hectic schedule at work or managing the needs of a busy household.
- *Type:* Muscular-strength training may be performed with many types of resistance equipment. However, like muscular-endurance training, the consistency and incremental weightloads provided by standard machine and free-weight exercises make these the preferred training modes for developing higher strength levels. Generally, linear exercises that involve multiple muscle groups utilized in the basic movements are the preferred method for increasing total-body strength. These exercises include squats, deadlifts, or leg presses for the squat pattern; step-ups and lunges for the lunge pattern; bench presses, incline presses, shoulder presses, and bar dips for the push pattern; and seated rows, lat pull-downs, and pull-ups for the pulling pattern. Rotary exercises that isolate specific muscle groups (e.g., leg extensions, leg curls, hip adductions, hip abductions, lateral raises, chest crosses, pull-overs, arm extensions, arm curls, trunk extensions, and trunk curls) should not be excluded from muscular-strength workouts, but these typically play a lesser role than the movement-based exercises that challenge multiple muscles at the same time.

Appropriate Rates of Progression in Strength Training

The recommended procedure for improving muscular strength is the double-progressive training protocol. There are numerous factors that affect the rate of strength development, and progress varies considerably among individuals. Consequently, it is not practical to suggest weekly weightload increases, as some clients will progress more quickly and others will progress more slowly than the recommended resistance increments. To facilitate individual stimulus–response relationships and to reduce the risk of doing too much too soon, health coaches should factor both repetitions and resistance into the training progression. First, the client's repetition range, such as four to eight repetitions per set, must be established. Second, the client can continue training with the same exercise resistance until the terminal number of repetitions (eight repetitions) can be completed with proper technique. When this is accomplished, the health coach should raise the resistance by approximately 5%, which will reduce the number of repetitions the client can perform.

EXPAND YOUR KNOWLEDGE

Obesity Does Not Result in Increased Muscle Strength

While it might be common to think that a person who weighs more due to excess body fat is consequently stronger than a normal-weight individual, the opposite is true. Obesity lessens a person's strength because excessive body fat infiltrates and weakens muscle tissue. When strength relative to body weight is considered, obese individuals tend to be much weaker (Messier, 2008). This lack of physical strength relative to total body weight can negatively impact the performance of ADL. Thus, while resistance training may not be the primary recommended mode of activity for weight loss for the obese population, it certainly is an important adjunct to the overall exercise program and should not be overlooked.

Prerequisite Muscular Strength Prior to Performance Training

Some athletically oriented clients will want to progress to performance-training to prepare for a specific athletic event or competition. The performance training phase (phase 4) focuses specifically on enhancing athletic skills for sports through the application of power exercises that emphasize the speed of force production, and the performance of specific drills that improve speed, agility, quickness, and reactivity. Clients who progress to performance training should have successfully completed both the movement- and load-training phases (phases 2 and 3). They should demonstrate good postural stability, proper movement patterns, and relatively high levels of muscular strength before initiating the performance-training phase. To facilitate maintenance and progress of posture techniques and movement training, these exercises can be incorporated in dynamic warm-up activities prior to performing performance-training workouts.

It is important for health coaches to understand that power training for performance involves advanced exercise techniques that can place greater stress on the musculoskeletal system than standard strength training. Consequently, health coaches should be certain that their clients have both the movement abilities and muscular strength to properly and safely execute the performance-training progressions.

Phase 4: Performance Training

This phase of training emphasizes specific training related to performance enhancement. Power training during the performance-training phase is an important component of sports-conditioning programs that helps prepare athletes for the rigors of their specific sport. Typically, this type of program is not appropriate for the average exerciser who is interested in improving general health and fitness. However, there are individuals who could benefit from adding power training to their fitness programs, such as middle-aged clients who have been strength training for months and are looking to improve their performance enough to participate in recreational sport activities. Older-adult clients can also benefit from certain forms of power training that emphasize power and quickness to help avoid falls. Furthermore, if designed and progressed appropriately, power training can add interest and fun to an existing exercise program.

Strength training performed during the load-training phase (phase 3) increases muscular force production, but does not specifically address the period of time during which the force is produced. Power training enhances the velocity of force production by improving the ability of muscles to generate a large amount of force in a short period of time. Power is needed in all sports and activities that require repeated acceleration and deceleration. Power can be defined as both the velocity of force production and the rate of performing work:

Power Equations

Power = Force x Velocity

Power = Work/Time

Where:

- Force = Mass x Acceleration
- Velocity = Distance/Time
- Work = Force x Distance

If a client meets all of the prerequisites for performance training and expresses an interest in amplifying his or her training regimen through high-intensity sports conditioning, the next step is to determine the purpose of the program. That is, the health coach must learn which fitness parameters or sports skills the client hopes to improve and then set out to design a safe and effective program to meet the client's goals. Answering the following questions may be helpful in determining an appropriate power-based performance-training program for a client:

- Which movement patterns and activities (aerobic vs. anaerobic) are required for the client to be successful in reaching his or her performance goals?
- What are the athletic skills and abilities the client currently lacks?
- What are the common injuries associated with the activity? For example, lateral ankle sprains are common in soccer, especially if the athlete has high arches, so incorporating drills designed to enhance a client's ankle reactivity, and thus stability, would be appropriate.

Plyometric Training Overview

To improve the production of muscular force and power, a conditioning format called **plyometric exercise** can be implemented. Plyometric exercise incorporates quick, powerful movements and involves the stretch-shortening cycle [an active stretch (eccentric contraction) of a muscle followed by an immediate shortening (concentric contraction) of that same muscle]. Lower-body plyometrics are appropriate for clients who play virtually any sport, as well as for those who want to enhance their reaction and balance abilities, as long as the client has developed the prerequisite strength to begin plyometric training and has learned first how to land correctly. Lower-body plyometric exercises include jumps and bounds (involving one leg or both legs) (Table 17-12).

Table 17-12

Lower-body Plyometric Exercises

Type of Jump	Description
Jumps in place	Jumps require taking off and landing with both feet simultaneously. Jumps in place emphasize the vertical component of jumping and are performed repeatedly with no rest between jumps.
Single linear jumps or hops	These exercises emphasize the vertical and horizontal components of jumping and are performed at maximal effort with no rest between actions.
Multiple linear jumps or hops	These exercises move the client in a single linear direction, emphasize the vertical and horizontal components of jumping or hopping, and are performed repeatedly with no rest between actions.
Multidirectional jumps or hops	These exercises move the client in a variety of directions, emphasize the vertical and horizontal components of jumping, and are performed repeatedly with no rest between actions.
Hops and bounds	Hops involve taking off and landing with the same foot, while bounds involve the process of alternating feet during the take-off and landing (e.g., taking off with the right foot and landing with the left foot). Hops and bounds emphasize horizontal speed and are performed repeatedly with no rest between actions.
Depth jumps or hops	These exercises involve jumping or hopping off of a box, landing on the floor, and immediately jumping or hopping vertically, horizontally, or onto another box.

Jumping and Hopping Tips

- Clients should land softly on the midfoot, and then roll forward to push off the ball of the foot. Landing on the heel or ball of the foot must be avoided, as these errors increase impacting forces. Landing on the midfoot also shortens the time between the eccentric and concentric actions (i.e., the amortization phase), thus increasing the potential for power development if another jump follows.
- Ensure alignment of the hips, knees, ankles, and toes due to the potential for injury, especially in women.
- Encourage clients to drop the hips to absorb the impact forces and develop gluteal dominance. Clients must avoid locking out the knees upon landing, which leads to the development of quadriceps dominance. Poor landing technique may lead to knee injuries, particularly in women. Proper hip mechanics during flexion and extension, along with the requisite muscular strength, is extremely important for developing lower-body power, which is why it is recommended that a client go through both the movement- and load-training phases (phases 2 and 3) before progressing to power-based exercises in the performance training phase.
- Instruct clients to engage the core musculature, which stiffens the torso, protects the spine during landing, and allows for increased force transfer during the subsequent concentric contraction (or jump).
- Clients should land with the trunk inclined slightly forward, the head up, and the torso rigid. Health coaches can cue clients to keep their “chests over their knees” and their “nose over their toes” during the landing phase of jumps.

For a more in-depth discussion about performance training, including assessments and program design suggestions for plyometrics, speed, agility, and reactivity training, refer to the *ACE Personal Trainer Manual*.

Summary

The primary mode of activity to facilitate weight loss is aerobic, or endurance, exercise. Aerobic conditioning maximizes caloric expenditure and reduces the risk of chronic disease. Health coaches can use the ACE IFT Model to program exercise selection, intensity, and duration to fit the special needs of overweight and obese clients. Many of these individuals may never progress beyond the aerobic-efficiency phase of cardiorespiratory training (phase 2), and many of them will never progress beyond the load-training phase of functional movement and resistance training (phase 3). Helping an obese client transition into the **action** stage and then on to the **maintenance** stage of change will have a significant impact on that client's health and overall quality of life, and may even have a positive impact on the client's state of physical and mental fitness.

References

American College of Sports Medicine (2010). *ACSM's Guidelines for Exercise Testing and Prescription* (8th ed.). Philadelphia: Wolters Kluwer/Lippincott Williams & Wilkins.

American College of Sports Medicine (2009). Position stand: Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine & Science in Sports & Exercise*, 41, 459–471.

Barnes, J.F. (1999). Myofascial release. In: Hammer, W.I. (Ed.) *Functional Soft Tissue Examination and Treatment by Manual Methods* (2nd ed). Gaithersburg, Md.: Aspen Publishers.

Campbell, W. et al. (1994). Increased energy requirements and changes in body composition with resistance training in older adults. *American Journal of Clinical Nutrition,* 60, 167–175.

Carpinelli, R.N. & Otto, R.M. (1998). Strength training: Single versus multiple set. *Sports Medicine*, 26, 2, 73–84.

Church, T.S. et al. (2010). Effects of aerobic and resistance training on hemoglobin A1c levels in patients with type 2 diabetes. *Journal of the American Medical Association*, 304, 2253–2262.

Cook, G. & Jones, B. (2007a). *Secrets of the Shoulder*. www.functionalmovement.com

Cook, G. & Jones, B. (2007b). *Secrets of the Hip and Knee*. www.functionalmovement.com

Di Pietro, L. et al. (2006). Exercise and improved insulin sensitivity in older women: Evidence of the enduring benefits of higher intensity training. *Journal of Applied Physiology*, 100, 142–149.

Esteve-Lanao, J. et al. (2005). How do endurance runners actually train? Relationship with competition performance. *Medicine & Science in Sports & Exercise,* 37, 496–504.

Foster, C., Daniels, J., & Seiler, S. (1999). Perspectives on correct approaches to training. In: Lehmann, M. et al. (Eds.) *Overload, Performance Incompetence and Regeneration in Sport.* New York: Kluwer Academic/Plenum Publishers.

Foster, C. et al. (2001). Monitoring exercise training during non-steady state exercise. *Journal of Strength Conditioning Research,* 15, 109–115.

Foster, C. et al. (1996). Athletic performance in relation to training load. *Wisconsin Medical Journal,* 95, 370–374.

Foster, C. et al. (1995). Effects of specific vs. cross training on running performance. *European Journal of Applied Physiology,* 70, 367–372.

Goldberg, L. et al. (1984). Changes in lipid and lipoprotein levels after weight training. *Journal of the American Medical Association*, 252, 504–506.

Gray, G. (2008). *The Thoracic Spine.* Adrian, Mich.: Gray Institute.

Gray, G. & Tiberio, D. (2007). *Chain Reaction Function*. Adrian, Mich.: Gray Institute.

Herman, L. et al. (2006). Validity and reliability of the session RPE method for monitoring exercise training intensity. *South African Journal of Sports Medicine,* 18, 14–17.

Houglum, P.A. (2010) *Therapeutic Exercise for Musculoskeletal Injuries* (3rd ed.). Champaign, Ill.: Human Kinetics.

Hurley, B.F. et al. (1988). Resistive training can reduce coronary risk factors without altering $\dot{V}O_2$max or percent bodyfat. *Medicine & Science in Sports & Exercise*, 20, 150–154.

Ibanez, J. et al. (2005). Twice-weekly progressive resistance training decreases abdominal fat and improves insulin sensitivity in older men with type 2 diabetes. *Diabetes Care*, 28, 662–667.

Kelley, G. (1997). Dynamic resistance exercise and resting blood pressure in adults: A meta-analysis. *Journal of Applied Physiology*, 82, 1559–1565.

Kendall, F.P. et al. (2005). *Muscles Testing and Function with Posture and Pain* (5th ed.). Baltimore, Md.: Lippincott Williams & Wilkins.

Kibler, W.B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. *Sports Medicine,* 36, 189–198.

Lieber, R.L. (2009). *Skeletal Muscle Structure, Function, and Plasticity: The Physiological Basis of*

Rehabilitation (3rd ed.). Baltimore, Md.: Wolters Kluwer/ Lippincott Williams & Wilkins.

MacIntosh, B.R., Gardiner, P.F., & McComas, A.J. (2006). *Skeletal Muscle Form and Function* (2nd ed.). Champaign, Ill.: Human Kinetics.

McGill, S.M. (2006). *Ultimate Back Fitness and Performance* (3rd ed.). Waterloo, Canada: Backfitpro.

McLester, J. et al. (2003). A series of studies: A practical protocol for testing muscle endurance recovery. *Journal of Strength and Conditioning Research,* 17, 2, 259–273.

Messier, S.P. (2008). The Burden of Obesity: A Biomechanical Perspective. Presented at the ACSM 55th Annual Meeting, Indianapolis, IN. May 28, 2008.

Norris, R., Carroll, D., & Cochrane, R. (1990). The effect of aerobic and anaerobic training on fitness, blood pressure, and psychological stress and well-being. *Journal of Psychosomatic Research*, 34, 367–375.

Rose, D.J. (2010). *FallProof!* (2nd ed.). Champaign, Ill.: Human Kinetics.

Sahrmann, S.A. (2002). *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, Mo.: Mosby.

Seiler, K.S. & Kjerland, G.O. (2006). Quantifying training intensity distribution in elite athletes: Is there evidence for an 'optimal' distribution. *Scandinavian Journal of Medicine & Science in Sports,* 16, 49–56.

Shumway-Cook, A. & Woollacott, M.H. (2001). *Motor Control: Theory and Practical Applications* (2nd ed.). Philadelphia: Lippincott Williams & Wilkins.

Starkey, D. et al. (1996). Effect of resistance training volume on strength and muscle thickness. *Medicine & Science in Sports & Exercise,* 28, 10, 1311–1320.

Tumminello, N. (2007). *Warm-up Progressions—Volumes 1 and 2.* Baltimore, Md.: Performance University.

Westcott, W.L. (2009). ACSM strength training guidelines: Role in body composition and health enhancement. *ACSM's Health & Fitness Journal,* 13, 4, 1–9.

Whiting W.C. & Rugg, S. (2006). *Dynatomy: Dynamic Human Anatomy*. Champaign, Ill.: Human Kinetics.

Willardson, J.M. (2007). Core stability training: Applications to sports conditioning programs. *Journal of Strength and Conditioning Research,* 21, 3, 979–985.

Williams, P. & Goldspink, G. (1978). Changes in sarcomere length and physiologic properties in immobilized muscle. *Journal of Anatomy,* 127, 459.

Suggested Reading

American College of Sports Medicine (2009). Position stand: Appropriate physical activity intervention strategies for weight loss and prevention of weight regain for adults. *Medicine & Science in Sports & Exercise*, 41, 459–471.

American Council on Exercise (2010). *ACE Personal Trainer Manual* (4th ed.). San Diego, Calif.: American Council on Exercise.

Carey, A. (2005). *The Pain-Free Program*. Hoboken, N.J.: John Wiley & Sons.

Kreighbaum, E. & Barthels, K.M. (1996). *Biomechanics: A Qualitative Approach for Studying Human Movement* (4th ed.). Needham, Mass.: Pearson Education.

Myers, T. (2009). *Anatomy Trains: Myofascial Meridians for Manual and Movement Therapists* (2nd ed.). Edinburgh: Churchill Livingstone.

Sahrmann, S.A. (2002). *Diagnosis and Treatment of Movement Impairment Syndromes*. St. Louis, Mo.: Mosby.